Engineering Library

AUG. 19 1929

AGRICULTURAL ENGINEERING

The Journal of the American Society of Agricultural Engineers

AUGUST 1929

Where Are We Today in Agricultural Engineering? - - - - - - *Arthur Huntington*

Five Years Irrigation Investigations on Peat Lands - - - - - - - *Lloyd N. Brown*

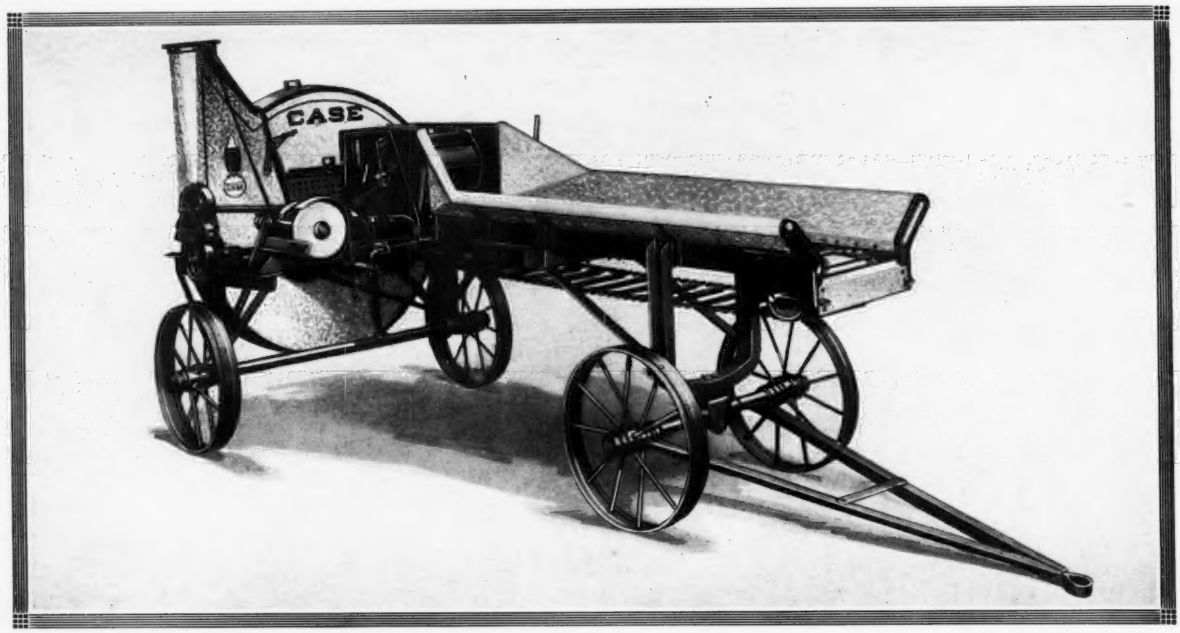
A New Design of Pump for Reclamation Service - - - - - - - *W. H. Holcomb*

Studies of Sewage Disposal for Isolated Homes - - - - - - - *Walker and Driftmier*

Pneumatic Tamping in Rammed Earth Construction - - - - - - - - *J. D. Long*

Design and Construction of the Electric Brooder - - - - - - - - *A. R. Wood*

VOL. 10 NO. 8



A Never-Ending Process

THE development and improvement of Case power farming machinery never ends. New scientific discoveries; new farming methods; tests and experiments made by independent investigators; field reports on machine operation —all are considered by Case engineers.

For instance, the Case Silo Filler had always proved itself a good machine as silo fillers go, but our engineers wanted to try some new principles. When their experiments were completed, the company had an entirely new and different machine to sell.

The result is a lighter machine, requiring less power to operate, and having remarkable capacity. The 1929 Case Silo Filler will take all the corn two or even three men can heave into it.

Another example of Case determination to build only machines with which farmers can do better work and make more money.

J. I. Case Co., Inc., Dept. H–2, Racine, Wis.

Est. 1842

The New and Greater Case Line

Tractors
Skid Engines
Threshers
Combines
Windrowers
Pick-up Attachments
Hay Balers
Silo Fillers
Walking Plows
Middle Breakers
Sulky and Gang Plows
Two Way Plows
Tractor Moldboard Plows
Riding Disk Plows
Wheatland Listers
Ridge Busters
Wheatland Disk Plows
Great Plains Disk Plows
Marsh Plows
Brush-Breakers
Spike Tooth Harrows
Spring Tooth Harrows
Harrow Carts
Disk Harrows
Orchard Disk Harrows
Clod Crushers
Grain Drills
Corn Planters
Cotton Planters
Cotton and Corn Planters
Manure Spreaders
Listers
Walking Cultivators
Riding Cultivators
Lister Cultivators
Grain Binders
Corn Binders
Mowers
Sulky Rakes
Side Delivery Rakes
Hay Loaders
Stalk Cutters
Field Tillers

CASE

QUALITY MACHINES FOR PROFITABLE FARMING

AGRICULTURAL ENGINEERING

Published monthly by the American Society of Agricultural Engineers
Publication Office, Bridgman, Michigan. Editorial and Advertising Departments at the Headquarters of the Society, Saint Joseph, Michigan

Subscription price to non-members of the Society, $3.00 a year, 30 cents a copy: to members of the Society, $2.00 a year. Postage to countries to which second-class rates do not apply, $1.00 additional. Entered as second-class matter, October 8, 1925, at the post office at Bridgman, Mich., under the Act of August 24, 1912. Additional entry at St. Joseph, Mich. Acceptance for mailing at the special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized August 11, 1921. The title AGRICULTURAL ENGINEERING is registered in the U. S. Patent Office.

W. G. KAISER, President — RAYMOND OLNEY, Secretary-Treasurer

Vol. 10 — AUGUST, 1929 — No. 8

CONTENTS

WHERE ARE WE TODAY IN AGRICULTURAL ENGINEERING? 245
By Arthur Huntington

IRRIGATION INVESTIGATIONS ON THE PEAT LANDS IN THE SACRAMENTO-SAN JOAQUIN DELTA 249
By Lloyd N. Brown

A NEW PUMP FOR RECLAMATION SERVICE 253
By W. H. Holcomb

STUDIES OF THE SEPTIC TANK METHOD OF SEWAGE DISPOSAL FOR ISOLATED HOMES 256
By H. B. Walker and R. H. Driftmier

TERMINOLOGY IN EARTH WALL CONSTRUCTION 258
By J. D. Long

PNEUMATIC TAMPING IN RAMMED EARTH CONSTRUCTION 259
By J. D. Long

STRENGTH TESTS OF KNOTS, HITCHES AND SPLICES 261
By J. Grant Dent

AGRICULTURAL ENGINEERING ADVERTISING 263
By D. B. Lucas

THE DESIGN AND CONSTRUCTION OF THE ELECTRIC BROODER 265
By A. R. Wood

A MECHANICAL REFRIGERATION STUDY 268
By M. P. Brunig

AGRICULTURAL ENGINEERING DIGEST 269

WHO'S WHO IN AGRICULTURAL ENGINEERING 271

EDITORIALS 272

A.S.A.E. AND RELATED ACTIVITIES 273

58 bearing positions on this Holt Combine are protected by HYATT ROLLER BEARINGS

Combines to turn in a record performance every season must be freed from delays. When Hyatt equipped, the vital working parts run cool and quiet, no stops ever required for bearing adjustments or repairs.

The dependable performance of Holt Combines, with all important bearing positions Hyatt protected, is typical of the service given by Hyattized equipment.

The "Caterpillar" Tractor, too, like its companion product the Holt Combine, is Hyatt protected at various locations.

The "Mark of Hyatt Protection" employed by many users. A complete list of Hyattized equipment will be sent to anyone upon request.

For many years combined harvesters built by Holt have been equipped with Hyatts, and the present day models built by the Caterpillar Tractor Co., Harvester Division, successors to Holt, are also equipped with Hyatts.

Which proves that Hyatt Roller Bearings have exceptional capacity for hard work under severe conditions, are long lived and carefree, requiring only an occasional lubrication to carry on for years at their appointed task.

Like the other leading makes of combines, threshers, tractors and all kinds of power farming machinery, Holt Combines rely on Hyatt to help assure continuous, profitable operation.

HYATT ROLLER BEARING COMPANY
Newark Detroit Chicago Pittsburgh Oakland

HYATT
ROLLER BEARINGS
PRODUCT OF GENERAL MOTORS

AGRICULTURAL ENGINEERING

Vol. 10 AUGUST, 1929 No. 8

Where Are We Today in Agricultural Engineering?

By Arthur Huntington[1]

AS AGRICULTURAL engineers, which way are we going? What has been our contribution? What is expected of us? Shall we be worthy of the trust placed in us?

In any group of engineers, economists, bankers, business men, churchmen, or what not, you will at the present time, as in the past, find two groups: (1) Those who are of the old school and think and counsel "clinging to the fundamentals," and following the traditions of their fathers, and (2) those who are thinking in terms of progress; they counsel new and better things, progress in thought, progress in action and progress in results.

There are both groups in this Society, and we hope there always will be, for the fundamentalist without the impetuosity of the progressive will soon fossilize, and the progressive without the steadying influence of the fundamentalist soon loses his moorings and contacts with society. He may become a pioneer, but more often he is just an ordinary radical.

For approximately three generations, under the influence of the progressive, America has forged ahead as no other nation in all history has done. Her inventors have dreamed dreams which her engineers have made practical; her manufacturers and business men have produced and distributed, and the people have accepted and used the product of these dreams, until today, as a nation, we are thinking not in terms of what has happened, but in terms of that which can be made to happen. Not in terms of necessity, but in terms of luxuries. Not in terms of money, but in terms of that which money will buy.

In any group of engineers today there seems to be a marked cleavage between two schools of thought: (1) Those who are expanding their thoughts and actions into the school of economics, business and sociology, and (2) those who are afraid they will have to.

We are here today to consider the future, but before we can intelligently do so let us not lose contact with the past.

Agriculture is one of the few industries which exists today in all of its various stages of development.

We have the savage with his berry patch and his roots and herbs gathered by the medicine men and women.

Fully half the world's surface is covered by men who practice agriculture in the pastoral stages.

Nearly half the world's people are, by the skill of their fingers and the sweat of their brow, following the practice of "making two blades of grass grow where one grew before," and by so doing are able to wring from the soil an existence.

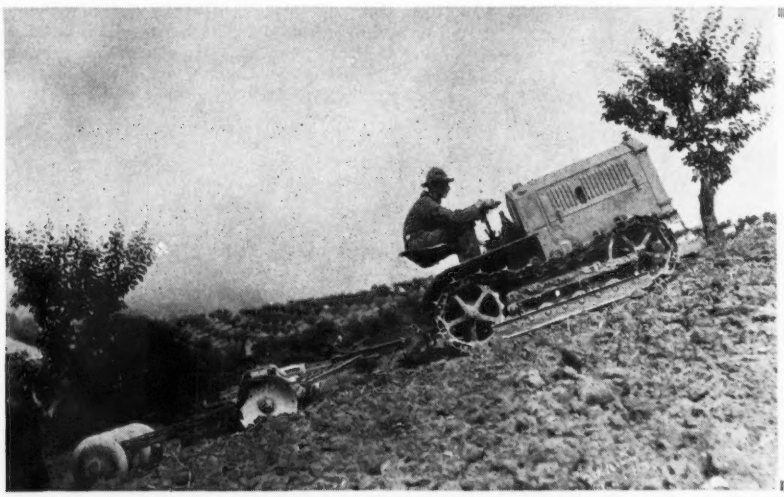
Even in those nations where, by the use of power and equipment, man has been able to multiply his efforts until one man does the work of many men, not so equipped, we find our industry in stages of development varying from the Oriental with his crooked stick for a plow and an ox, or woman, for his power plant, up to the most highly mechanized agriculture.

No group of engineers are as blessed with living examples of the development of their industry as are we, and none are as cursed by the traditions of the past. Yet with it all our contribution to society has been great.

By the use of power and equipment we have made it possible for one worker to produce sufficient food, clothing and shelter to maintain three workers in those industries which produce the things which stand for better living standards.

We have multiplied the producing power of the worker

[1]Public relations engineer, Iowa Railway and Light Corp. Mem. A.S.A.E.



By the development of suitable equipment and the application of mechanical power, the engineer has made it possible for one worker to produce sufficient food, clothing and shelter to maintain three workers in those industries which produce the things which stand for better living standards.

The hand of the engineer is to be seen in all phases of agricultural development. In addition to giving to agriculture better machinery and better methods, he has reclaimed agricultural lands for productive purposes. His chief effort in this direction at present is to reclaim valuable waste areas on established farms.

until we now produce in man-minutes that which formerly took man-hours. We have made it possible to profitably cultivate lands which a few years ago were considered marginal.

But what of the future? Shall we confine ourselves to the equipment of agriculture, or shall we become interested in its economics? Shall we continue to think in terms of efficiency of production, or shall we turn our attention to the well-being of those engaged in the industry of agriculture? Shall we think in terms of how to keep people on the farm, or shall our interest be the intelligent transfer of replaced workers to other fields of usefulness?

As engineers we have demonstrated that nations are prosperous, not in proportion to the number of people on the land, but in proportion to the fewness of properly equipped workers who are able to maintain agricultural production.

In a sense we are responsible for the surpluses of agriculture, both in men and products, for at the same time we have produced surplus crops, released many workers and made those who are poorly equipped inefficient.

We have been a factor in creating many of our rural problems. We cannot, if we would, and would not, if we could, avoid the responsibilities of helping to solve them.

The development of such societies as this, meeting once a year for the exchange of ideas, is slow. Such organizations are the creation of men of purpose who not only must progress, but men who are willing to progress by giving to others.

1. They must first meet and organize, and the very act of meeting and organizing calls for leadership.
2. They must have leaders who will direct their destinies so that the society will grow strong and attract the best men of the profession to its ranks.
3. When the organization becomes strong and has rendered a service, it becomes necessary to sell its value, first, to the business and professional world, and then to society as a whole.

Few organizations have been as blessed with men of purpose for its founders as was the American Society of Agricultural Engineers. Truthfully we can call them the fathers of agricultural engineering. They have been leaders in the educational and industrial world, and after rendering many years of active service to this society, they have remained as its advisers. Yes, it can truly be said that they are the fathers of the profession and of this society. But they are more; they are today, as in the past, active and progressive leaders. I know of no greater tribute to the founders of this Society than to say that each of the twelve men, who met to organize it, have served as its president.

As leaders, they attracted other engineers to them and molded the destinies of the Society. They sold the profession of agricultural engineering to agricultural engineers.. They have made agricultural engineering a recognized branch of the profession, and are now engaged in making society at large appreciate their contribution, to the place that our members are being called upon to help solve the problems of today and the future.

They are being invited into the councils of men in high places. Their views are quoted in the public press and their recommendations are being unconsciously accepted by the rank and file of every day people.

These traditions may entitle us to a voice in high places, but they definitely fix on us a responsibility which we gladly accept.. We must and do assume our part in the responsibility of solving the economic problems of agriculture. We assume a responsibility in fitting agriculture in with those industries which have only been made possible on account of the releasing of workers from the arduous task of producing food. We assume our part or the responsibility of making it possible for workers in this basic industry to have those living standards accorded to other workers.

But more. We must exert new influences. It is our duty to see that agriculture is basicly analyzed, in order that each integral part may be understood and intelligently handled by a layman. Allow me to mention briefly a few of these problems.

Transportation is vital to agriculture, yet no agricultural agent is permitted to have much voice in such matters. Our public roads, while largely farm to market highways, are being developed for the convenience of cities and tourists. Do not for a moment think that I am opposed to our trunk highways. They are basic, but no more basic than the farm to market road which is now little more than a politician's dream.

Who has analyzed the cost and value of transportation by rail and water as an agricultural asset? The men whom I know, who are the leaders in such movements, are politicians and construction men and bond brokers seeking tax exempt securities for those people whose incomes are in the surtax class. Personally, I do not know a single man who is advocating inland waterways who has ever investigated the problem basicly, by separating the terminal costs from the transportation costs.

In my home state the freight charge for hauling a carload of wheat a mile is four times as much as that charged for a carload of vegetables under ice, and nearly twice as much as the charge for hauling a carload of livestock. The livestock and vegetables require special equipment, which returns empty, whereas wheat is shipped in standard equipment.

So much for freight charges. How about freight costs? Our railroads and the Interstate Commerce Commission

and our politicians do not think in terms of cost. The railroads follow traditions, whereas our regulating bodies are influenced too much by political expediency. This body should become interested in rural transportation as a factor in the freight charges of commerce.

The processing of the products of the farm, be they primary or secondary agriculture, come within the scope of our interests. Not many years ago each farm was a diversified factory, whereas today little manufacturing is even attempted. It was in the regular trend of events that manufacturing should disappear from the farm, but it was bad for agriculture when the processing moved too far. Many of our agricultural problems are the result of the lack of opportunity for the producer of farm products to assist in their processing.

Recently I observed a case where agriculture was being handicapped by shipping its hogs more than fifteen hundred miles to be processed. In order to maintain this remote packing house, it was necessary to maintain a $2.00 per hundred pound freight differential in favor of live hogs, as against meat. This rural producing community was deprived of not only the consuming and buying power of those who processed their product, but were deprived of a chance to sell their labor in a market which was maximum at a time when farm labor is idle.

This problem may be economic and involve labor, transportation and marketing, but it is a problem which we, as engineers, should analyze and help to solve.

The motto of agriculture, since time prehistoric, has been to "make two blades of grass grow where one grew before," until agriculture, business and industry have come to think of it as the basic problem of agriculture. It is basic and will become more so as each succeeding crop is taken from the land, but it is only one of many problems.

Production per worker is of equal, if not of greater, importance and will remain so until the press of increased population has taken up the available surplus land.

Production per acre beyond a certain limited amount is the result of excess, detailed labor, working inefficiently, whereas the production per worker is the direct result of the use of those things which the engineer has provided.

There should be no conflict between those who are attempting to increase yields and those who are striving to increase the production per worker. Nor has there been conflict. The crop's man has done a good selling job and we, as engineers, have done a poor selling job.

As engineers we must enter the sales field. We have sold our "services," but we have failed to sell our "value." Many times we have made large contributions to civilization and utterly failed to call the world's attention to our contribution and its worth.

There is a third basic agricultural problem which is of interest to engineers, namely, the production per dollar invested. Too many rural values have been placed by the real estate man and the speculator and the sentimentalist, and not enough by the production man backed up by sound, economic principles.

Please allow me here to call attention to the close working relationship which should exist between the engineer and the economist. Both are interested in what has happened; both should be interested in what can be made to happen. Both are interested in "net efficiency."

The engineer, therefore, must become interested in finance in that he must help provide the means of producing a return on the value of the property invested.

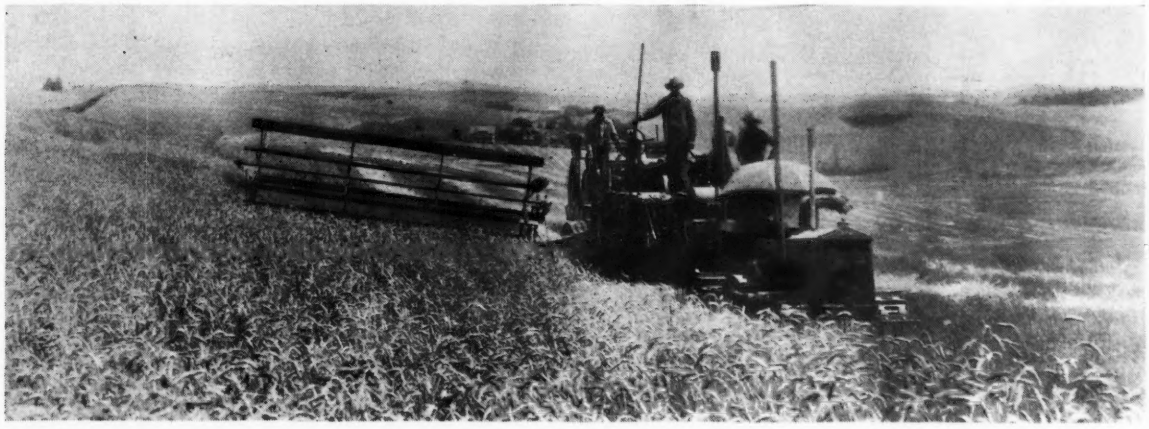
We hear much of agriculture as a "mode of living," and of "the sanctity of the American rural home" and "better standards of living," but in the last analysis these become a reality only where there is less drudgery, shorter hours, more equipment and more comforts, all of which can only come when more where-with-all is provided, whether it is secured in money or in kind. I think you will agree with me that there is a social phase of our engineering.

The world is fast beginning to appreciate that when properly trained, the engineer is the highest type of executor. As proof allow me to say that the largest political executive in the world today is Herbert Hoover, an engineer; and the head of the highest commercial organization, the United States Chamber of Commerce, is Wm. Butterworth, another engineer.

It will interest you to know that the governors of nine of our states are high-grade engineers, and that more than thirty engineers are in the senate and house of representatives of our national congress. But each of these leaders are men who augmented their engineering training with a leadership which came with executive training. Gentlemen, one of the major problems of the American Society of Agricultural Engineers to solve is the providing ways and means whereby young engineers may acquire training and become executives.

The most crying need in the field of agriculture today is for men with engineering training and executive ability and experience. These men are wanted for three types of work:

1. As consultants who can advise landowners, who to date have depended upon themselves and tenant farmers who do a poor job of practicing the prejudices of agriculture.



The tendency to larger scale operations in agriculture and the development of larger equipment units involve more engineering problems than is the case under horse-farming conditions. For this reason the need is increasing for men with engineering training and executive ability and experience. This field should prove more and more attractive for agricultural engineers

2. As advisors to banks, trust companies and insurance companies, which have their funds invested in agricultural securities.
3. As operators of large tracts of lands which, on account of the reverses of agriculture, have come under one management.

There is another field which I have not listed as calling the engineer, for it is a field which does not call; it must be claimed. I refer to the field of ownership.

Personally, I know of no field which offers the opportunities for financial success as the field of agriculture. But the field must be developed in conformity with the laws which govern agricultural finance and operation, and not according to the rule as now applied to the industry. I think I state the truth when I say that agriculture's greatest problem today is to reorganize the industry so that it will conform to the basic laws which govern it, and to wean it away from the rules laid down by those who have tried to make agricultural practices conform to the rules of other business.

Agriculture does not conform to the rules of either merchandising or manufacturing, but is a part of that group of industries which do not sell their property, they simply deal in the produced returns from their property. It belongs with the public utilities group and follows their laws insofar as primary production is concerned.

In conclusion, let us briefly outline the engineer's contribution to agriculture and then project into the future, the road he should travel.

Briefly, as an artizan he gave to prehistoric agriculture a few crude implements which sufficed the needs of the industry until about 1850, when the artizan became first the inventor-mechanic and then the engineer.

During the next fifty years designing and engineering became an integral part of agricultural equipment.

From about 1900 to the present time the engineer has been bettering machinery and power plant many times by the improvement and adaptation of old and well-known machines. It was during this period that agricultural engineering became a recognized branch of engineering and such terms as "efficiency," "production per worker," "man-hours," became a part of agricultural vocabulary.

We are now in the period of impressing our importance upon the business of agriculture and on the world of economics, finance and business. Our entry has been made, and we are being permitted to sit at the council table.

It now remains for us to render our full contribution. Our course is clearly charted. How shall we account for our talents?

1. We have sold the idea of a basic analysis of agriculture.
2. The economics of the industry of agriculture is coming to the front along engineering lines. The tiller of the soil, the holder of his securities and the consumer of his products are thinking in terms of efficiency, in terms of what can be made to happen.
3. We must be a factor in fitting agriculture into those industries with which it must deal.
4. Sociological problems requires that we become interested in the well-being of those engaged in the industry.
5. If we are to render our maximum service we must become operators and executives and provide means of training young engineers to become operators and executives.
6. As executives we must exert a leadership in proportion to our contribution and according to our capabilities.
7. We must back our faith by becoming owners in the industry which supports us.
8. Last, but not least, we must "think and act quantitatively but with weighted perspective."

Improved Forests Help Flood Control

THAT the forests of the Mississippi drainage basin, under proper protection and care, will store immense quantities of rain water, reduce the rapidity of run-off, and thus assist in reducing floods is shown by a detailed report on the relation of forestry to flood control issued by direction of the Committee on Flood Control of the House of Representatives. The report, prepared by the Forest Service, U. S. Department of Agriculture, recommends strongly that the improvement of forest conditions throughout the basin should have a part in the flood prevention program as a necessary supplement to engineering works.

What are described as "some startling facts" are brought to light in the report. It is shown that the forests of the Mississippi watershed, even in their present largely mismanaged condition, were responsible for a reduction in the possible flood crest of nearly 15 inches. Were all the forests of the Mississippi drainage area protected and managed in accordance with established forestry principles, it is declared, a further reduction in possible flood crests of 55 inches would be possible. This restraining effect would be equivalent to the storage capacity of some 4.6 reservoirs each with a capacity of 10,000,000 acre-feet.

Recommendations made in the report may be summarized as follows:

Completely organized forest-fire protection as the first step in improving forest cover should be rapidly put into effect by the Federal Government, the States, and the landowners.

Cooperative forest planting should be extended, so that idle and waste submarginal lands may be reforested. Results will be of increasing value from a flood standpoint through increased local water retention, and decreased run-off and erosion. Planting is important in many of the critical areas, particularly in the bluff region from the Ohio River southward, in southwestern Wisconsin, and in the Ohio River drainage. Machinery for carrying out these first two recommendations already is provided in the Clarke-McNary forestry act.

Increase is recommended in forest extension activities to acquaint owners of submarginal or forest lands with the best methods of treating these lands. This calls for increased activity among farm woodland owners under existing authority in the Clarke-McNary act, and for further authority to carry this extension to other than woodland owners.

Continued protection and administration of the national forests, parks, and game refuges under present policies is recommended, and addition to the national forests of adjoining forested areas of unreserved public domain to insure the protective benefits found in organized Federal administration.

Prompt extension of public ownership is recommended in many critical forest areas; first, in order that the Federal Government may have the direct jurisdiction necessary to enable it to improve forest conditions on lands which now contribute unnecessarily large and destructive run-off, and second, to enable the Federal Government to protect heavy investments in flood-control structures, the permanency of which would otherwise be jeopardized by serious erosion. In addition to lands within purchase units already approved, the report indicates some 6,000,000 acres in critical areas which should be administered as public forests. For the better management, protection, and reforestation of the remaining 125,000,000 acres of forest land in the Mississippi watershed not in public ownership, reliance is placed on individual and cooperative effort, stimulated by Federal and State cooperation and leadership.

Irrigation Investigations on the Peat Lands in the Sacramento-San Joaquin Delta[1]

By Lloyd N. Brown[2]

IRRIGATION investigations have been in progress during the last five years in the peat lands of the Sacramento-San Joaquin Delta. The work was started when, due to a shortage of fresh water, the salt water from San Francisco Bay backed up into the Delta channels. The purpose of these investigations was to secure data that would aid those concerned with the administration of the water in these rivers. Irrigation, navigation, and industrial interests were concerned. However, before going into the details of this work it will probably be of interest to consider some of the more general features of the region.

Geology. From the geologist's point of view the soil in the Sacramento- San Joaquin Delta is of too recent origin to be of more than passing interest. The soil comprising the valleys has been eroded from the mountain ranges on either side. In some places it is known to be two thousand feet deep. Such depths of soil would indicate that the valley was gradually sinking while the filling process took place because the soil does not show evidence of having been deposited under water. The location of the fault or faults along which the sinking of the earth's crust takes place is not definitely known.

The distribution of the peat would indicate that this fault line was somewhere toward the westerly side of the peat belt. Consider a line running east and west and about six miles north of Stockton. Going in a westerly direction along this line the peat will be first encountered in very shallow deposits. As you continue the peat becomes progressively deeper for about fifteen miles until it reaches the maximum depth of fifty feet or more. The composition of the peat indicates that it has been formed from remains of plants of the genus scirpus that grow best under swampy conditions. Since this is true the soil underlying the deepest deposits of peat at one time must have been at sea level. As the soil gradually sank the peat layer thickened and the area of peat lands increased. The time required for the formation of the deeper deposits of peat would probably be in the order of magnitude of one hundred fifty thousand years.

In this manner a large area of peat was built up with the river channel and sloughs meandering through it. At high tide the surface was covered with water and at low tide the surface was exposed. In the summer dense masses of tules grew in profusion and in winter they died down and, undergoing only partial decomposition under water, added to the peat deposit.

Reclamation of Islands. The full story of the reclamation of this region would fill volumes. Some of the first reclamation took place soon after the gold rush in 1849. The levees built up then were very small. The material was moved by man power via the wheelbarrow route. At the present time large dredgers with 150-foot booms and handling 3-yard buckets do the work. Practically all of the land has been reclaimed and is now being farmed.

In the early days the winter run-off frequently topped some of the levees and flooded the islands. Those landholders who could afford to build their levees highest were the least injured. Finally dredgers removed some of the bottlenecks of the river and straightened them out until now an island is rarely lost.

Irrigation System. The typical irrigation system is composed of flumes or siphons, or both, 4-foot ditches, spud ditches, the main drainage canal and pump. A so-called 4-foot ditch is about 5 feet deep, 30 inches wide, and is dug by machine. One of these ditches into which the flumes and siphons discharge is made parallel to and about 100 feet from the inside toe of the levee. The island is then subdivided insofar as is practical by 4- foot ditches into checks about 1200 feet square. The drainage canal is located through the central portion of each island and up to a point in the levee where the drainage pump is installed. The drainage canals are usually about 25 feet wide and 10 feet deep. Each check is subdivided by spud ditches, which are about 2 feet deep and 10 inches wide. These spud ditches are made each year but the rest of the irrigation system is permanent.

Spud ditches are dug by a ditcher which is capable of moving at about 4 miles an hour. They are installed

[1]Paper presented at a meeting of the Pacific Coast Section of the American Society of Agricultural Engineers, at Stockton, Calif., April, 1929.

[2]Field engineer, University of California, and U.S.D.A. California State Division of Water Rights, Berkeley, Calif.

(Left) Method of installing soil moisture requirement tanks so as to get earth transferred in place. The bottom of the inner tank is held in place by long bolts. (Right) Corn in tanks at harvest time. That in the foreground tramped down so that picture could be taken. Notice the four-foot ruler in the second tank from the right

across each check at intervals of from 50 to 80 feet according to the needs of the crop irrigated. The water is held at proper heights by means of dams or drops in the spud ditches. The crop between the ditches is supplied by lateral movement of water from these ditches. The elevation at which the water is held varies with different crops and also between different stages in the development of the same crop. Thus the water comes over or under the levees into the 4-foot ditches which distribute it to the spud ditches which in turn discharge into other 4-foot ditches which carry the excess to the drainage canal from which it is pumped back into the channel surrounding the island.

Crops Grown. According to the soil maps, the Delta is composed of 423,000 acres, of which 180,060 are peat and 242,940 acres are sedimentary soil. About 250,000 acres of irrigated crops are grown each year. The leading irrigated crops grown in the Delta in point of acreage are asparagus, beans, alfalfa, corn, potatoes, sugar beets and fruit.

A good many other crops are grown on a much smaller scale among which are celery and onions. The sugar beet acreage appears to be increasing quite rapidily.

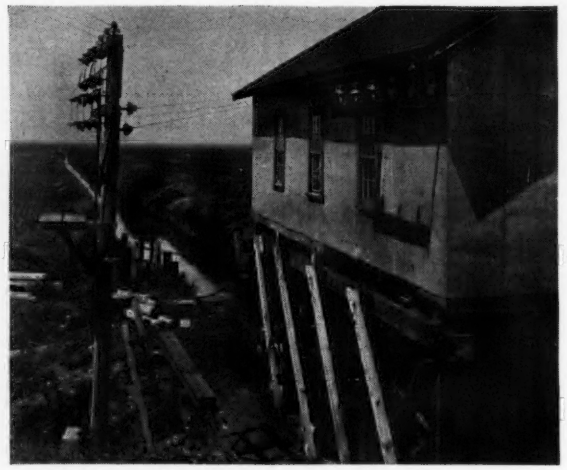
The productivity of the soil appears to be almost unlimited. This is especially true of the peat. The world's record potato yield, slightly over 30 tons per acre, is held by Delta growers. In fact two of the leading growers alternate in holding it, one holding it for a year or two and then being runner-up for a like period. Last year, 1928, a farm of 500 acres averaged 25 tons of sugar beets per acre. This is not an exceptional yield for these peat lands. The per cent of sugar, however, is quite low, but it is anticipated that this difficulty can be overcome to a considerable extent by changing some of the growing practices. Experiments now under way are expected to shed some light on this subject. Celery yields of 250 crates, about 1750 dozen heads per acre, are not uncommon. Onions yield as much as 600 sacks per acre. The greater part of the world's supply of asparagus is grown in the Delta. About 90 per cent of the world's canned asparagus supply is put up here.

Salt Water Encroachment. The channels of the Delta region are directly connected with some of the upper arms of San Francisco Bay; consequently there is a tidal fluctuation in this region. The water in the Delta channels is supplied by the run-off of the Sacramento-San Joaquin rivers. Therefore, if the supply of fresh water is diminished the salt water will penetrate up stream. If the water gets very brackish, it is rendered unfit for irrigation in the Delta and for industrial uses by factories on the upper arms of the bay. This is what has happened in years of light run-off.

The dry season of 1918 was the first year that the salt water problem really became acute. However, this was not due to any sudden development but rather to the gradual development of irrigation projects on the upper reaches of the rivers and then combined with a season of light run-off. It was now apparent that some provision would have to be made to guard against the salt water in the future. Litigation was threatened but a calmer and more effective means of procedure was effected. Realizing that lawsuits could not produce more water, steps were taken to ascertain the actual needs of all interested parties.

In the spring of 1924 another water shortage was evident. Funds were raised by contributions from interested parties and an organization was set up to investigate the problems confronting the Delta water users. Such investigations are still in progress. Since the initial year the expense has been carried by federal and state agencies.

At the present time two schemes of alleviating the situation have been proposed. One is to build a salt water barrier across one of the narrows of the upper bay;



A typical drainage installation in the Sacramento-San Joaquin Delta. The picture shows pump house and canal

the other is to build a dam on the upper Sacramento River where part of the winter run-off can be impounded. During the summer this water can be released to add to or maintain the size of the fresh water lake in the Delta. This plan will probably be followed in time by the salt water barrier. In any system whereby the problem can be solved a great deal of data must be at hand as to the requirements of the different parts of the state. To arrive at a satisfactory solution of the problem it is necessary to know the water needs of different parts of the state. There was considerable data available on the water requirements of lands in other parts of the state, but nothing definite was known of the needs in the Delta. Consequently it was necessary to see what could be done to determine the water needs of the Delta farmers.

Medford Measurements. In 1924 an island of about 1200 acres, planted almost entirely to potatoes, was selected for use of water studies. The peat in this locality was about 30 feet deep. The water admitted to and that drained from the island was measured. It was let into the island through about a dozen siphons. A rectangular weir or submerged orifice, depending on conditions, was installed at each inlet. By means of them and water-stage recorders a continuous record of the water admitted to the island was secured. The drainage pump was calibrated by means of special apparatus so that with a record of the elevation in the drainage canal and also in the river the discharge could be computed.

The difference between the amount of water admitted and that drained showed a net use of 0.28 acre-feet per acre. Such a figure does not represent nearly all of the water used by the crop because normally you would expect to get a use in the vicinity of 1.5 acre-feet per acre or larger. Consequently large amounts of water were supplied from other sources. In this particular case the amount must have been in the neighborhood of an acre-foot per acre at the minimum. The only source from which it could have been obtained was from underground seepage. Whether the water was supplied by lateral seepage through the peat from the river or from vertical seepage from underlying strata was not determined. From later results, obtained from work on other islands, it is probable that both sources contributed.

It was decided for the immediate future at least to work for the most part on smaller tracts. A field in a larger island probably would not be affected to such a large extent by seepage as a whole island. Moisture requirement tanks were also included in our future pro-

gram. They would give a good indication of a plant's needs when grown in the peat.

Field Measurements. The irrigation water used by ten different fields has been measured during the last four seasons. The water was measured by rectangular weirs and water-stage recorders. The field measurements for the various crops and years are shown in the following table:

	1925	1926	1927	1928
Potatoes	21.97—0.70	18.38—3.18	18.63—1.46	
		11.84—3.38		
Corn		33.11—2.40		
Celery		2.18—1.10	16.45—1.35	
Sugar Beets			19.27—1.14	0.87
Onions			25.02—2.50	
Asparagus		No irrigation		

The potatoes show a variation of from 0.70 to 3.38 acre-feet per acre. The maximum use of 3.38 acre-feet per acre is probably nearly correct. It appears fair to assume that the other fields were influenced by a supply of underground water; otherwise they would have used a like amount. Measurements have been made on only one field of corn. The use of 2.40 acre-feet per acre is probably fairly indicative of the irrigation water used by corn.

The two celery fields are in rather close agreement. The figures given, 1.10 and 1.35 acre-feet per acre, do not include water used in raising the young plants in beds before transplanting into the field or of the water used in flooding the field preparatory to setting out the plants. If these two uses are taken into consideration the use would be about 2 acre-feet per acre. Since celery is not harvested until late in the fall early rains may have a material bearing on the use of water.

Sugar beets showed a use of 1.14 and 0.87 acre-feet per acre on two successive years. These uses appear to be quite low but the consistency of the results of two years observations would lead one to believe that these figures are probably in the order of magnitude of the irrigation water necessary to apply. The amount of water actually used by the beets is probably considerably higher than this because the beets when maturing after the irrigation season is over lower the water table a couple of feet.

The water has been measured on only one onion field. The use of 2.5 acre-feet per acre, while quite high, is probably about correct. Onions have a fairly short irrigation season, but the water is held very close to the ground surface so the surface evaporation must be high.

Our observation on use of water by field grown asparagus is limited. The ranch where our tanks are located has discontinued irrigation the last couple of years. Since the asparagus is cut until July 1, practically the only water lost up to that time would be by evaporation from the soil surface. During the months when the tops are growing the water table goes down 2 or 3 feet. If we neglect any increment to the ground water by vertical seepage under pressure, the amount of water used as indicated by the lowering of the water table would only amount to a few tenths of a foot. Very probably the crop uses more water than this indicated amount so there must be some other source of supply other than depletion of soil moisture.

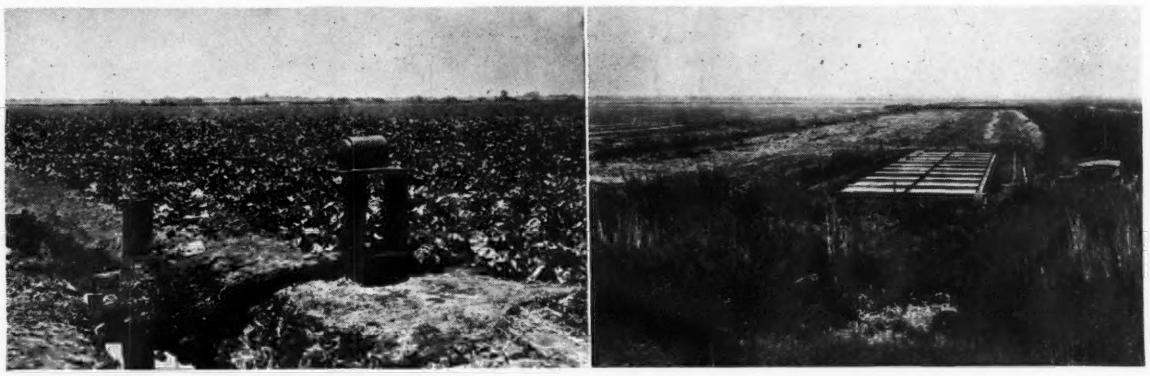
In all the fields just discussed it is felt that the supply of underground water has been a very important factor. It is also very difficult to devise any satisfactory method of measuring the amount of water obtained from this source. Several experiments of a preliminary nature now under way may indicate a feasible method of approach.

Tank Measurements. Since field measurements had certain disadvantages as just enumerated, soil moisture requirement tanks were also resorted to, to determine the actual use of water. These tanks consist of an outer water-tight jacket about 5 feet deep and an inner perforated tank containing the soil. Between the two is an annular space for the water supply. By adding or withdrawing water from this space any water table within the limits of the tank can be secured. The area of the tank is designed to be of a size approximately equal to that of the area occupied by a plant under field conditions. The plot adjacent to the tanks is planted to the same crops as the tanks so as to have the plants growing in the tanks as nearly as possible under field conditions. Another feature of the inner tanks is that the soil is transferred to them in place. Due to a removable bottom the inner tank may be forced down into the soil. The soil can then be dug away from around the tank and the bottom jacked into place and fastened. In this way the soil is transferred in an undisturbed condition except for a slight compaction.

The tanks are arranged in groups so that at least six or eight may be used for the same crop because such repetition makes the results more reliably indicative of actual conditions. This is especially true when working with crops where there is a wide variation in individual plants.

Table I gives the results of tank work; as would be expected the results are slightly higher than those obtained from field measurements because the unknown amount of seepage water the plants in the field obtain is cut off from the tank.

The results for potatoes are not held to be indicative because the roots and tubers were attacked by nematodes. Since this attack reduced the vigor of the plant, curtailed



(Left) A typical water stage recorder installation. A two-foot rectangular weir is in the ditch immediately behind the box. A four-foot supply ditch is shown in the foreground. The crop is sugar beets. (Right) Experimental plots for determining the efficacy of flooding with water for the control of nematodes (caconema radicicola)

TABLE I. Use of Water by Tanks
(Acre-feet per acre)

	1925	1926	1927	1928
Potatoes	1.34			
Corn		3.65	2.88	
Celery			1.03	
Asparagus			1.67	3.41
Sugar beets				3.36

its productiveness and shortened its life, the use of water obtained is probably considerably lower than that required to produce a good crop. The use of water shown for corn and celery is probably about correct. That used by the asparagus tanks shows the use for the first two years. Since the life of an asparagus plant is twelve or fifteen years and its maximum production is not reached until it is about six years old, these figures for the first two years are only applicable to those specific years.

While tank work has certain limitations, in that crops growing in them are not under absolute field conditions, yet the results from this sort of work will show the use of water obtained when the variable factor of underground water suply is removed.

Underground Water Supply. A good many of our field measurements have indicated that water was available to the plant from sources other than those supplied by irrigation. In the first year's work on Medford Island the use of water was very low. Apparently the water admitted for irrigation served more to regulate the water table than as a source of supply. Later a single field that yielded approximately the same amount of potatoes on two successive years used 0.70 and 3.38 acre-feet per acre during these same two years. Obviously water was supplied from some unknown source on the year of smaller use. Another interesting feature was disclosed by comparing the accumulated mass diagrams of tanks and fields. A tank gives the curve that you would expect, i.e., a slow rate of use followed by a rapid rate and finishing off with a decreasing rate. A field usually gives practically a straight line when plotted this way. This would again show that there was some other source of water available in the field besides that supplied by irrigation.

Some evidence has been collected to show that water is available from other sources. The natural assumption would be that the water seeps laterally through the peat under the levee. To a certain extent this is true, but the zone so affected as shown by a limited number of observations is but a few hundred feet wide. The shape of the water table in an island is similar to a dinner plate—a rather narrow zone near the levee where the water table slopes away from the levee and then flattens out for the main body of the island. From the physical characteristics of the situation it would be impossible for lateral seepage through the peat to move beyond the zone of inclined water table. In that part of the island where the water table is approximately horizontal, a good many wells or probes have been installed. In cases where two probes are installed close to each other with the openings at 5 and 10 feet below the surface, respectively, the water as a general rule stands higher or closer to the ground surface in the deep probe. This situation would indicate an upward movement of water. From the several phenomena just mentioned it would seem fair to assume that the crops receive water, in addition to that supplied by irrigation, by lateral and vertical seepage The lateral seepage undoubtedly comes from the channels surrounding the islands. The water supplied by vertical seepage may also come from the channels but there is no evidence to prove or disprove this assumption. It is evident that this problem will require considerable more study.

Nematodes. We have been seriously hampered, especially in our tank work, by the common garden nematode (Heteradera caconema). This pest is very serious in the Delta, having rendered large areas unfit for susceptible crops such as beans, potatoes and celery. Many schemes have been evolved for the control of them in small areas such as greenhouses, but those that are efficient are not economically practical under field conditions. Flooding as a possible means of control was mentioned frequently in the literature on nematodes. If any system of flooding was proved to be effective in the Delta, the practice would undoubtedly become quite popular.

A plan to see whether or not flooding was beneficial was evolved and put into operation in July, 1928. Twenty plots, 12 feet square in a double row were built on heavily infested ground. The partitions of the plots extended about 10 inches above and 20 inches below the ground surface. The water was supplied by a flume under the levee that spilled into a regulating box. This box discharges into a flume which runs along one side of the plots and spills into them. The box is built low on one side so as to provide a spillway for excess water.

All plots were kept under water from July 18, 1928, to January 22, 1929, with the exception of two or three periods of a few hours each. On January 22, 1929, six plots were drained and the balance are still under water. Samples taken at the time the six plots were drained later showed that living nematodes were present. These results would indicate that six months flooding under the conditions enumerated does not eradicate nematodes.

In addition to the nematodes as related above there are many other pests and diseases which apparently are eradicated or controlled by water. Also if peat land is flooded for a few months its productivity is greatly increased for following crops. There are many such features which may have a material bearing on the amount of irrigation water which Delta lands require.

In retrospect, it appears that considerable more work will have to be done on crops not yet experimented with so as to obtain the use of water of the major Delta crops. After that data has been obtained further work of a more intensive nature will be in order. It is felt that there is yet a large field to be explored in practical field irrigation. For instance, it would be of great value to the farmer if the present system of subirrigation could be modified so as to lessen the alkali accumulation at the surface. Again no work has been done on the different forms of soil moisture. It is not known even approximately the upper and lower ranges of percentage content at which the moisture in the soil is at the optimum for plant growth. There are many other features of the same general nature that can be looked into, to the benefit of the administrator, investigator and farmer.

A five-standard subsoiler operating on a farm of the California Packing Corporation. Subsoilers and deep tilling cultivators are used extensively on California farms. Owing to their deep penetration draft requirements are high and they are operated almost altogether by tractors

A New Pump for Reclamation Service[1]

By W. H. Holcomb[2]

IN DESIGNING a pump to successfully fulfill the conditions encountered in modern irrigation and reclamation services, two factors must be given major consideration: (1) Absolute dependability and (2) maximum operating economy.

On first thought it might seem that the dependability of a pumping equipment is perhaps not as important as economy of first cost and operating expense. However, experience has proven otherwise in many cases where the equipment to be installed has been chosen purely on a basis of cost and without particular regard to the ability of the pump to stand up under continued hard service. Obviously the most efficient pump built is of no value unless it is available for immediate service when needed and is so constructed that it will continue to operate successfully during as long a period as the requirements of the service may demand.

The reliability of a pump may also be considered to have a very direct and important bearing on the cost of operation, as failures during the operating period may conceivably result in extremely serious damage to crops due to lack of water on an irrigation project, or the reverse condition with a drainage plant.

In either an irrigation or drainage development the cost of pumping the water is of maximum importance, and of course must be given careful consideration in choosing the equipment to be installed. The operating cost of the pumping plant is made up of a number of items, including, in their order of importance, efficiency, cost of maintenance, and interest charges on the capital investment.

The efficiency of a pumping plant is of course the relation of the water delivered to the cost of the power used in delivering that water. On first thought it appears that the problem of analyzing pump efficiency is a simple one that can easily be determined on the basis of the efficiency guaranteed by the manufacturer. On the contrary, however, the guaranteed efficiency of the pump proper is only a small part of the overall plant or project efficiency and accordingly other points should be given equal consideration. The factors entering into the determination of the project efficiency include the efficiency and power factor of the motors and other electrical equipment used, the design of the discharge pipes, inlet structures and even the design and arrangement of the distribution canals, conduits and laterals.

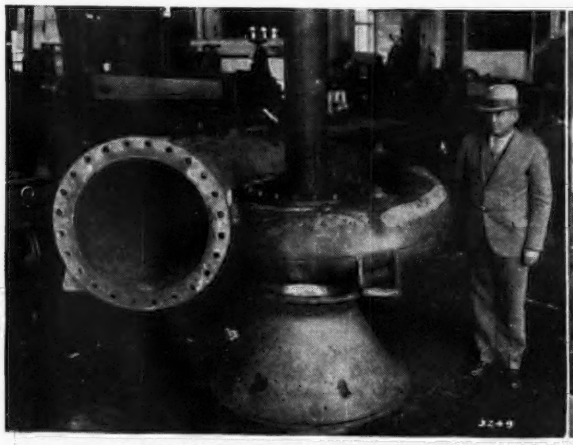
To expand this point consider, for example, a case where a slow speed highly efficient pump may be under consideration and where due to the slow speed of the pump the efficiency and power factor of the driving motor are considerably reduced. It can then readily be seen that the overall efficiency of such a unit would not be as high as would the overall efficiency of a unit operating at twice the speed, where the pump efficiency was only slightly lower than that of the slow speed pump, while the efficiency of the high-speed motor was considerably greater. In addition, in the case of a high-speed unit the motor power factor would be higher and a further saving would be effected in the construction of the foundations and building due to the smaller size of the high-speed equipment.

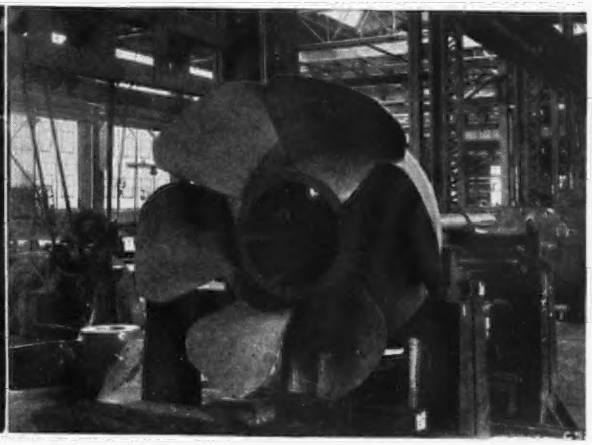
Another factor which is encountered unfortunately in the majority of the irrigation and drainage projects in the West is the fact that considerable amounts of sand and silt is carried in the water and the pump efficiencies obtained on the initial tests are most difficult to maintain throughout the life of the equipment. Accordingly, it will readily be seen that the engineer in analyzing the efficiency of pumping equipment, particularly of fairly large size, should give careful consideration not only to the efficiency of the pump but also to the overall project efficiency, which can reasonably be expected and most important to the mechanical design of the unit or units under investigation in an endeavor to determine if the design offered is one which will show a minimum of wear in handling water with sand and silt in suspension and which will maintain a sustained efficiency closely approximating the original efficiency throughout its operating life. While it is of course highly desirable to obtain the most efficient pumping equipment posible, it is also equally if not more desirable to choose a design of equipment in which the problem of sustained efficiency over the operating life of the unit has been taken into consideration.

The second major item usually considered in choosing a pumping plant is the cost of maintenance. This in-

[1]Paper presented at a meeting of the Pacific Coast Section of the American Society of Agricultural Engineers at Stockton, Calif., April, 1929.

[2]Manager, pump department, Pelton Water Wheel Co., San Francisco.





(Left) The Moody spiral type of pump designed for reclamation service, particularly for conditions requiring the delivery of comparatively large volumes of water against the low and medium heads normally encountered in irrigation and drainage work.
(Right) This picture shows the impeller of the Moody pump

cludes in the broad sense time out of service due to breakdowns, renewals or repairs as well as the cost of making repairs, the cost of repair parts and the cost of operating attendance. Where the pumping equipment must be operated 24 hours per day and seven days per week for periods of several months during the irrigating season and where the unit must be available to go on the line at any time during the season in a drainage project, the type of construction adopted must be sufficiently sturdy to insure a minimum of time out of service. For these same reasons in developing a successful type of pump, simplicity of design must be adhered to so that there will be as few parts as possible to wear or need renewal while the design must be laid out so that when repairs or renewals are needed they can be installed in the shortest possible time. This point is vital and is one that is being carefully studied by both the manufacturers and users of the modern type of pump.

In many of the earlier irrigation and drainage projects, in California particularly, the horizontal type of pump was used, and inasmuch as positive priming could not be obtained due to the arrangement of the installation, the cost of operating attendance was a very considerable part of the total operating cost. Modern pratice has considerably reduced this particular item in that most of the plants now being installed are of the vertical-shaft type arranged for submerged operation, which of course provides positive priming and permits readily working out a successful system of automatic control. This automatic control is generally accomplished in the case of electric-motor-driven units by the use of float switches. In most cases two switches are used, the first operating in the discharge canal and so arranged that when the water drops to a predetermined level, the unit will come on the line and will continue to operate until the water again reaches the maximum level when the pump will shut down. The second switch is installed in the forebay or supply canal and is an auxiliary, its entire function being to prevent the unit from starting if the level in the suction supply basin or forebay has dropped below the point where the starting of the pump might cause considerable injury to the rotating parts.

With the modern type of plant arranged for submerged operation with consequent automatic priming and electrical control through float switches, it is possible, in fact, practical, for a single operator to take care of two or three plants having six or more units in each plant. Comparing the operating payroll of a plant of this type with the operating payroll of a plant where horizontal equipment is used and the danger of the unit going off the line is such that one or more operators are required at each plant, it will readily be seen that the resulting saving in salaries provides a very considerable reduction in the overall cost of operation.

The matter of interest on capital investment is one with which every purchaser or user of machinery of any kind is thoroughly familiar, and therefore it seems almost unnecessary to say a great deal regarding that portion of the plant cost. However, it might be well to point out that the actual cost of the machinery going to make up a pumping plant is not the total capital investment; in fact, in many cases it is only a small portion of that investment. In arriving at the total cost of the plant, careful and complete consideration should be given to the cost of the building in which the equipment will be housed and the cost of the foundation on which the equipment will rest. Often it is found that when the total cost of a project is analyzed on this basis, the initial cost of the particular pump which might appear low on the first analysis is in reality considerably higher than the overall or total cost of the unit which costs slightly more and which is so designed that the cost of building and foundation required for its successful installation is much lower. Another point which should always be borne in mind by anyone purchasing a pumping unit is that in a great many cases, in fact, the majority of cases, the initial cost of the plant is not nearly as important in the ultimate economy achieved as the reliability, operating efficieny and cost of maintenance.

On the Pacific Coast there are two general types of irrigation and drainage plants installed. The first is the individual plant serving either all or a part of the requirements of a single individual and having a capacity of probably from one to five cubic feet per second and where the deep-well turbine type of pump is generally used. This type of pump is well known and has reached a very high state of development particularly in California.

The second type of installation is that used in organized projects such as irrigation and drainage districts where the capacity of the equipment is sufficient to serve a considerable area and where there are usually several plants each having from two to six units with a unit capacity varying from possibly a minimum of 10 cubic feet per second to a maximum of 100 cubic feet per second, or more.

For this latter type of service a comparatively new type of unit, which has proven particularly successful, is now being built. The pump was conceived and developed by Lewis F. Moody and is known as the Moody spiral type.

The Moody spiral type of pump is designed particularly for conditions requiring the delivery of comparatively large volumes against the low and medium heads normally encountered in irrigation and drainage work. This pump may be built for either a horizontal or vertical setting, but in order to provide automatic priming and make possible the use of automatic control of the driving motor it is generally built for vertical shaft operation.

The design is extremely simple and the possibility of outages due to repairs, renewals or breakdowns, is practically eliminated. The impeller used is of the open or unshrouded type and in its general appearance somewhat resembles a propeller as used in marine work, having very large openings between the vanes which greatly reduce the possibility of clogging due to debris. The design of the impeller is unique in that the pressure changes through the impeller are extremely small, the main function of the impeller being to change the direction and magnitude of the velocity. This design has a very distinct and practical advantage in that it obviates almost entirely the necessity of close running clearances subject to sand wear.

Accordingly, sustained efficiency is obtained with the Moody spiral pump, whereas in the case of the conventional centrifugal pump sustained efficiency is impossible except where frequent and expensive renewals are made in the wearing surfaces due to the fact that considerable differences in pressure take place in the impeller requiring the maintaining of these close-running clearances.

As a matter of record, the first Moody spiral pumps built were installed in the graving dock at the Kensington Ship Yards at Philadelphia, where they have been in continuous operation for a period of ten years. Recent tests on these units indicate that there has been no loss in their original efficiency. In 1922 four Moody pumps of large capacity were installed in the Sumas Dyking District of British Columbia. These pumps have operated during each season since that time and when they were inspected recently by the officials of the District no evidence of wear was found. The pumps, incidentally still furnish the initial rated capacity at the original efficiency.

With the spiral pump simplicity of design is developed to the highest possible point and the number of parts going to make up the unit are comparatively few. The volute or casing is a single casting except in extremely large units and is fitted for the attaching of the pump head cover and suction inlet section. The head cover, except in the very small sizes, is removable and permits the raising of the entire rotating element without the necessity of disturbing the casing setting, discharge pipe or suction bell. This type of design is of particular value in that

it reduces to a minimum the time required to inspect or repair the working parts of the pumps.

The main bearing is carried in a suitable recess provided for that purpose in the pump head cover and is usually of the split type permitting ready removal when necessary. This bearing in a normal design is arranged for grease lubrication under pressure from the motor floor.

Another outstanding and valuable characteristic of this type of pump is the fact that it is inherently a high-speed unit, maximum efficiency and operating results being obtained at high rotating speeds. These speeds are normally about twice those obtained from the double-suction centrifugal pump for the same conditions. This characteristic is of practical value in that it reduces initial cost due to (1) the smaller size of equipment required for a given duty, which, of course, means less floor space and smaller foundations, and (2) the reduced cost of the higher speed prime mover particularly in a normal case where electric motors are used. This is true because the electric motor is also a high-speed unit, and if the installation of a pump necessitates the use of a slow-speed motor, not only is the first cost of the motor increased but more important still the electrical characteristics are not nearly as favorable as is the case in the higher speed motor.

The Moody spiral type of pump has been used on a great many projects in the eastern part of the United States, many of the pumps having been in operation for periods of as long as ten years. These installations without exception are outstanding in that outages for repairs or renewals are practically unknown, while the pumps even after a period of ten years continue to give the initial rated capacity at the orginal efficiency .

Quite recently contracts have been obtained by the manufacturer for this type of equipment on two large projects in California as well as several smaller ones. One of these projects is a new development where it is anticipated that the operating cost of the project as a whole will be lower than any previously obtained on similar projects in the West. The second large installation will replace existing horizontal shaft centrifugal pumping machinery which has been in operation about nineteen years. In this latter case it is estimated by the engineers in charge of the work that the initial saving made possible by the installation of the spiral pumps will amount to about $17,000 per year on an investment of roughly $150,000 which obviously is very much more worth while.

A Successful Farm Record Form

Editor AGRICULTURAL ENGINEERING:

I HAVE just read your January issue with great interest and profit. I am glad to note that you and your contributors do not consider a forward look taboo. I agree heartily that we should have something better to do than merely trail along behind with wise observations.

I note that several of your contributors stress the importance of farm accounting, and I am therefore taking the liberty of offering a farm record form which is the result of several years experience I have had here as secretary-treasurer of The Noble Foundation, Ltd.

You will note that it is a double entry synoptic system. I have used this system in other matters than time sheets and believe it is the ideal plan for submanagers, men who have both feet planted squarely on the job. Being well acquainted with the actual work they are the men who will detect and correct any entry false in fact, and the requirements of the double entry feature insures accuracy in their work.

I have found in actual practice, as in keeping of elevator grain records (weights of grain instead of time) that it is an effective check on dishonesty, that it penalizes carelessness heavily, and that even the most obtuse can master it and use it successfully.

In explanation: In the accompanying form the men's time is given only in days. By providing more columns the wages could also be given both on the "Men's Time" side and on the "Job Records" side.

(An entry in parenthesis means that the figure must be subtracted instead of added to make up the total at the bottom.)

The entry March 10 may mean that C.D. was given his time, and that on line 11 means that Job No. 1 is completed and should be charged to Crop No. 5.

TIME SHEET March 1929	Men's Time								Job Record					
	AB $5 Per D	CD $3 Per D	EF $2 Per D	30-60 Tractor Gang No. 1				Time Transferred to Ledger	Job No. 1	No. 2	No. 3	No. 4		Work Charged to Crops
1	1	1	1						3					1
2	1	1	1						2	1				2
S 3														3
4	1	1	1							3				4
5	1	1	1							3				5
6														6
7														7
8														8
9														9
S 10		(4)						4						10
11									(5)		TO CROP NO. 7			11 5
12														12
13														13
14														14
15														15
16														16
S 17														17
18														18
19														19
20														20
21														21
22														22
23														23
S 24														24
25														25
26														26
27														27
28														28
29														29
30														30
S 31	(4)		(4)					8						31
	0	0	0					12	0	7				5
									Job totals must equal time totals					

Time could be kept for a piece of machinery like the "30-60 Caterpillar," or, if certain men and equipment are working steadily together, they may be designated as Gang No. 1, thus reducing the time and effort of bookkeeping on the foreman's part to pretty nearly nothing.

This system can be used for other purposes, of course, such as animal records, acquired, on hand, and disposed, or crop records showing prospects, yields, on hand, losses, disposition, etc.; and a foreman once introduced to the system in one form can readily master its use for additional purposes with a minimum of instruction.

It furnishes the accountant with the most dependable data possible from which to build his cost accounting and serves as a concise record for future reference, a feature of considerable importance from year to year in farm management.

N. J. NOBLE.

Secretary - treasurer,
The Noble Foundation, Ltd.
Nobleford, Alberta

Studies of the Septic Tank Method of Sewage Disposal for Isolated Homes

By H. B. Walker[1] and R. H. Driftmier[2]

THE septic tank method of sewage disposal for isolated homes is practiced extensively in the rural districts of the United States. The simplicity of construction and the small amount of attention required for operation have a strong appeal to the home owner who must depend upon an independent sewage disposal system. Hundreds of such systems are being installed annually without a definite knowledge of the character of the sewage to be treated, its flow characteristics, the temperature changes taking place within the tank, the behavior of the scums and sludges, and many other factors which may have an important bearing upon the safest and most satisfactory method for the disposal of the sewage from the isolated home.

The data submitted in this report, it is believed, add materially to our limited knowledge on these points. These data have been developed from a series of investigations[3] carried on since 1922 by the agricultural engineering section of the Engineering Experiment Station of the Kansas State Agricultural College.

Previous to starting these studies, a review was made of the literature available to farmers and others on the disposal of sewage from isolated homes. These studies indicated that the designers of farm septic tanks were fairly well agreed on the general construction of the simple septic tank, but little data were available to substantiate their designs. Prior to the time of the beginning of this project (1922) no exact information as to the daily and seasonal variation in sewage flow per person was available. Accordingly many of the sewage disposal systems discussed in these publications are based on deductions resulting from municipal practice, or are the reproductions of the work from some other experiment station.

These investigations of data and information available indicated that none of the stations were agreed on the volume of sewage flow, or the total capacity of the settling chamber as expressed in hours of retention; and there was also a considerable variation in the capacity of the settling chamber[4] in terms of cubic feet of volume per person. These stations were all of the opinion that the rectangular-shaped tank, constructed of concrete, was the best and that the ratio of width to length should be about 1 to 2. The majority favored a sewage depth in the settling chamber of from 4 to 5 feet.

The design of the dosing chamber likewise indicated a lack of experimental data for design. The capacities and the frequencies of dosing varied greatly.

It was further indicated that the final disposal of the effluent was cared for by subsurface irrigation, filtering beds, and broad irrigation, preference being in the order named.

A notable exception to the above observations is the work of Frank and Rhymus reported in Public Health Bulletin No. 101[4]. Their studies, however, relate principally to Imhoff tanks.

The Kansas studies have been conducted on two separate tanks located on the farms of the Kansas State Agricultural College. These will be known hereafter in this paper as the Agronomy Farm installation and the Poultry Farm installation.

Agronomy Farm Installation. A two-chamber (septic chamber and dosing chamber) septic tank (Figs. 1 and 2), equipped with automatic siphon, was installed at the college Agronomy Farm, November 24, 1922. The Agronomy Farm includes 320 acres devoted largely to field crops. The eight-room house is modern and is not unlike any other Kansas farm home, equipped with modern conveniences. The plumbing appliances consist of a toilet, bathtub and lavatory, shower bath and kitchen sink, and the basement is equipped for laundry work. Both cistern and well water are provided. The cistern water is pumped by hand. The well water supply is provided by a hydropneumatic system.

The number of people living in the house varies with the urgency of the farm work. During the progress of

[1]Professor of agricultural engineering, University of California. Mem. A.S.A.E.

[2]Professor of agricultural engineering, Kansas State Agricultural College. Mem. A.S.A.E.

[3]Project No. 57, Engineering Experiment Station, Kansas State Agricultural College.

[4]The Treatment of Sewage from Single Houses and Small Communities, by Leslie C. Frank, assistant sanitary engineer, U. S. Public Health Service, and C. P. Rhymus, assistant sanitary engineer, U. S. Public Health Service, P.H.B. No. 101, Dec. 1920.

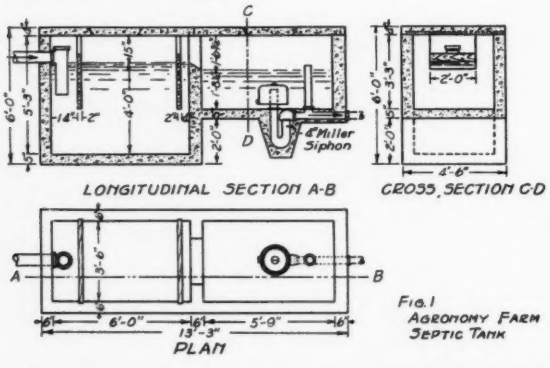


Fig. 1. Plan and section view of the Agronomy Farm septic tank used in the Kansas sewage disposal studdies

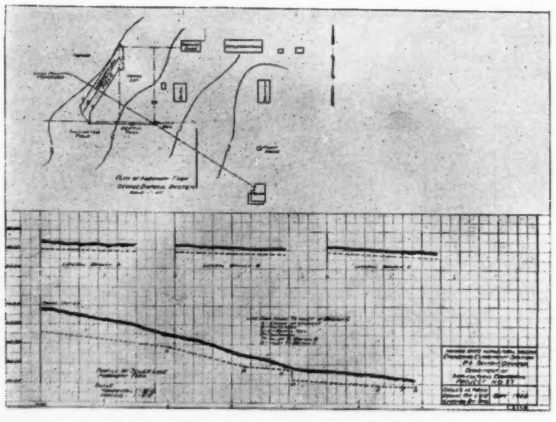


Fig. 2. Plan and profile of the Agronomy Farm (Kansas) sewage disposal system

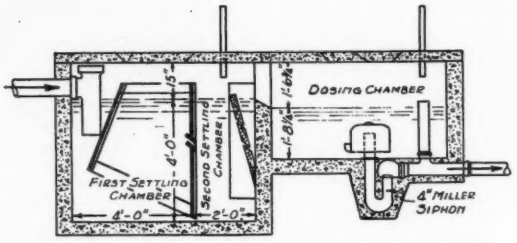


Fig. 3. This shows the baffling system of wood construction which divided the septic chamber into two compartments. This baffling system was changed in April, 1927

these investigations the number varied from seven to eleven persons.

The sewage is carried away from the house through a 6-inch vitrified clay sewer line to the septic tank. This is a two-chamber tank equipped with a 4-inch Miller automatic siphon. The tank was designed (empirically) to accomodate a family of from six to twelve persons. The septic chamber, which is 3 feet 6 inches wide, six feet long, and 4 feet in depth below the flow level, has a capacity of 84 cubic feet, or 620 gallons. At the time this tank was constructed no investigational work had been conducted on farm installations to determine the average rate of sewage flow per person per day. Assuming a family of six people, with a sewage flow of 35 gallons per person per day (based upon data provided by the occupants of the home), this capacity made provision for a 60-hour retention period.

The baffling system in this tank was changed on April 16, 1927. This wood construction (Fig. 3) divided the septic chamber into two compartments. The first compartment was given approximately the same retention period as the Poultry Farm septic chamber, and the second compartment was fitted with the same type of baffle as the Poultry Farm installation.

The dosing chamber is 5 feet 9 inches long, and 3 feet 6 inches wide, and was designed for a drawing depth of 17 inches. This provides a 30-cubic foot or 225-gallon capacity. Based on the above assumptions, the dosing period would be approximately once in 24 hours.

Previous to the septic tank installation, the household wastes were carried into a leaching cesspool. A switch box (Fig. 2) was constructed in the sewer line to provide a means of diverting the sewage to the septic tank and to enable the investigators to switch the sewage back to the cesspool when construction changes in the tank were necessary. The connecting line from the switch box to the septic tank is 6-inch vitrified clay sewer tile laid to a grade of 6 inches per 100 feet. To secure proper depth for the absorption system, the effluent is carried through a 6-inch vitrified clay sewer tile to a second diversion box. This box serves as a distribution chamber to the absorption line.

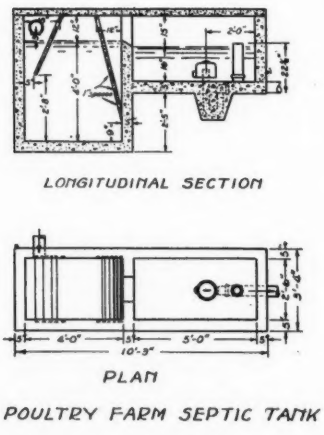
The absorption system consists of three lines of 4-inch drain tile, spaced 16 feet apart. The combined length of these is 500 feet. These laterals were laid on different grades; the lateral designated as "A" (Fig. 2) has a grade of 3 inches per 100 feet, lateral "B" was laid to a grade of 4¾ inches per 100 feet, and lateral "C" was laid to a grade of 9½ inches per 100 feet.

Poultry Farm Installation. A two-chamber tank equipped with automatic siphon was installed at the college Poultry Farm, June 28, 1926. This farm consists of a 12-acre tract devoted entirely to poultry production. The 9-room house is equipped with a kitchen sink, bathtub and lavatory. The water supply is secured from the college mains. The number of people living in the house varied from three to eleven during the period of these investigations.

The tank (Fig. 4) was designed to accommodate a family of six persons. The settling chamber, which is 2 feet 6 inches wide, 4 feet long, and 4 feet in depth below the flow line, has a capacity of 40 cubic feet or 300 gallons. Flow records on this system indicate that the average septic tank retention period is 60 hours. The maximum period recorded was 110 hours, and the minimum 35 hours.

The dosing or siphon chamber is 5 feet long, 2 feet 6 inches wide, and the siphon drawing depth is 13 inches. This provides a 13.5-cubic foot, or a 100-gallon capacity. Based on the average rate of sewage flow for the period under investigation (19.2 gallons per person per day) the dosing period is approximately once in 20 hours.

The septic tank is connected to the house plumbing with 66 feet of 6-inch vitrified clay sewer tile. This tile was laid with cemented joints at a one per cent grade. A line of 4-inch vitrified clay sewer tile laid at a two per cent grade connects the tank to the absorption system. The absorption system (Fig. 5) consists of 204 feet of



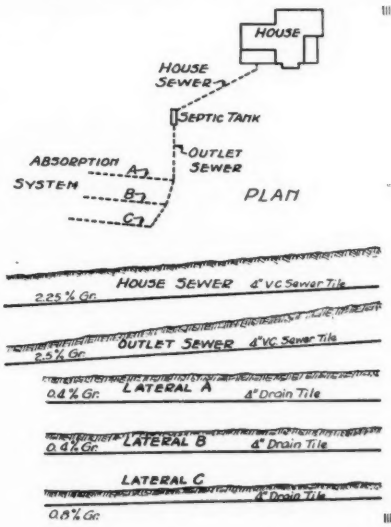


Fig. 4. (Extreme left) Plan and section views of the Poultry Farm septic tank used in the Kansas sewage disposal studies
Fig. 5. (Left) Profile of the tile lines in the Poultry Farm sewage disposal installation

4-inch drain tile. These are arranged as three laterals 15 feet apart. Lateral A was placed about 24 inches under ground, Lateral B about 18 inches deep, and Lateral C at a depth of approximately 15 inches. All lines are laid on a grade of 6 inches per 100 feet. The absorption field is planted to alfalfa. Examination of the tile 28 months after installation indicates there has been no tendency for the roots to enter the tile.

The system was put into operation July 16, 1926. The investigational work on this system extends over a period from August 30, 1926 to March 18, 1928.

EDITOR'S NOTE: This is the first of three installments of this paper by H. B. Walker and R. H. Driftmier. The second and third installments will appear in the September and October issues, respectively.

Terminology in Earth Wall Construction

By J. D. Long[1]

SOIL has been and is being used in various parts of the United States in erecting small structures. Such use is for floors, as a structurally inert insulating material over ceilings, as a roofing, and especially as a material for walls. This terminology is concerned with the various methods of wall construction; in it an attempt has been made to define the methods under the simple, readily understood, English terms which are already more or less widely applied and so do away with the confusion which now exists due to the use (and misuse) of some foreign terms.

The methods of incorporating earth into walls may be listed under five general heads: Sun-dried brick, rammed earth, poured earth, mud-walling and earth filler walls. These names are not as distinctive and self-explanatory as might be desired and afford opportunity for improvement, but it is believed that they are preferable to some of the obsolete and arbitrarily derived foreign terms which have been commonly used in describing this work. The description of each method follows; it will be noted that each provides for a thorough working or "puddling" of the soil in a damp or wet state before or as it is being worked into the wall.

Sun-Dried Brick, frequently termed "adobe" or "adobe brick," are regular-shaped blocks of well-mixed mud, which have subsequently been dried in the sun. Short lengths, up to 6 inches, of straw or other vegetable fiber is usually, although not always necessarily added to the mud. The bricks are commonly 4 or 6 inches thick and from 8 to 30 inches in their other dimensions; a common size for a bearing wall is 4x12x18 inches which contains a volume of ½ cubic foot and weighs approximately 45 to 50 pounds. The brick are laid in a wall similar to the laying of ordinary burned brick. A mud mortar is commonly used, although lime or cement mortars may be used. Integral reinforcements may be placed as the walls are built.

Much confusion exists regarding the use of the word "adobe" in connection with this form of building. "Adobe" is a Spanish-Mexican word meaning sun-dried brick; "adobero" from the same source means to mix or puddle. For some unexplained reason soil surveyors and pedologists have adopted the term "adobe" to define "a soil which on drying cracks and breaks into irregular but roughly cubical blocks. . . . . Adobe soils are usually heavy textured and high in content of colloidal clay." Due to the fact that such soils are difficult or impossible to use in any method of earth wall construction without an admixture of some lighter soil or gravel, care should be exercised in using the term "adobe" in connection with earth wall construction.

Rammed Earth, or "pise' de terre," as it has been known in French, is a method consisting of tamping damp soil between forms to make a monolithic wall. Straw or other vegetable binder has not customarily been included with the soil, but integral metallic reinforcement is sometimes recommended. Unit farm pannels are customary, and the wall is erected in successive courses. A four-inch thick layer of loose soil is spread in the form and tamped; it will compact to approximately two and one-half inches. This routine is continued until the two-foot high form is full; the form is then removed and set up on another section of wall. Forming blocks of rammed earth to be laid up in a wall similar to sun-dried brick or precast concrete blocks has not proven as successful as the monolithic rammed earth method. Tamping by hand has been the universal practice in the past but in a few modern examples of this style of building pneumatic tampers have been used.

Poured Earth, or "mud concrete," is a method consisting of pouring a well-mixed mud between forms, much as portland cement concrete is poured. Pouring continuous courses about the wall six to twelve inches deep appears to be the most successful practice although walls nine feet high have been successfully erected at one pouring. Straw or other vegetable binder has not customarily been used.

Mud Walling, or "cob," consists of piling stiff mud, in which straw has been mixed, along the wall in courses. Forms are not used. Forks full of the prepared mud are dropped compactly in place around the wall for its full thickness and to heights regulated by the stiffness of the mud. Before the layer is dry the sides are trimmed plumb with a hay knife. As soon as the work already completed has dried sufficiently hard to support a load another course is added, the process being repeated until the wall stands at the desired height.

Earth Filler Walls, variously known as "half timber," "terra armada" and "binding work," include any method whereby a skeleton structural frame work is erected of other material and puddled soil used to form the filler walls between the frame members. In this country wood timbers have usually formed the framework and sun-dried brick or poured earth the filler walls. This method is the only one wherein the earth wall itself does not support the roof load.

There are deviations from these briefly described methods, but it is believed that these five are the general types to be found. It will be readily perceived that they differ in forming bearing or filler walls, in the methods of puddling the soil; in the amounts of water used in the soil, in the use of straw or other integral reinforcement, in the use and type of forms, in the size of working crew most efficient, and very probably in the soil type most suitable for use with each method and the climate most favorable to each form of construction.

If interest in the subject of earth wall building continues, it would appear necessary to have a logical division of the work into named methods that progress in experimentation and education may progress without confusion.

[1]Junior agricultural engineer, University of California. Assoc. Mem. A.S.A.E.

Pneumatic Tamping in Rammed Earth Wall Construction[1]

By J. D. Long[2]

A PORTABLE air compressor and tamper were borrowed for this phase of the experimental work in progress at University Farm (University of California) at Davis from the Sacramento Division, Pacific Telephone and Telegraph Company, through the courtesy of C. L. Sarver, division plant methods engineer. It consisted of a 7½-hp. New-Way single-cylinder, air-cooled gas engine; a belt-driven, two-cylinder, No. 62 (3x4-inch) Kellogg compressor; and a 30-gallon Kellogg air tank. This equipment, together with convenient cases for hose, tools and supplies, was mounted on a Ford chassis. The tamping tool used was a product of the Chicago Pneumatic Tool Company and was rated to use 20 cubic feet of air per minute at 75 to 80 pounds pressure.

Two tamping heads were used. One was a cylindrical 3-inch (diameter), hollow, cast head with a slightly concave tamping face provided as standard equipment. The other was a head built up for this experiment and had a wedge-shaped tamping face, the two sides forming a 90-degree angle. In use the latter was found to tend to throw the soil out at the sides and so require a longer time to consolidate the soil layer. Since the compacted layers appeared about equally dense the flat-faced tamper was used for the major portion of the work.

Only three difficulties, all of minor importance, were experienced in the operation of this equipment. It was found impossible to exactly control the placing tamper so that it roughed up the sides of the forms, particularly as the work came near the top of the forms. Lining the wood forms with sheet metal would probably have over come this difficulty.

The second difficulty was due to the vibration set up in the completed wall by the tamper; in the 12-inch thick walls this was not detrimental, but it was found advisable to hand tamp the first three layers in a new set-up on the 9-inch walls to avoid breaking loose the top layers of the course below. After the bottom three layers had been tamped the pneumatic tamper could again be used without setting up a destructive vibration in the forms.

The third difficulty was the capacity of the compressor. The 7½-hp. engine was not operating the compressor at highest efficiency and over a four to six-minute period the tank pressure would drop below that required to operate the tamper. As the operator was continually shifting about in the form and giving the equipment brief rest periods to build up a pressure head the actual loss of working efficiency was slight.

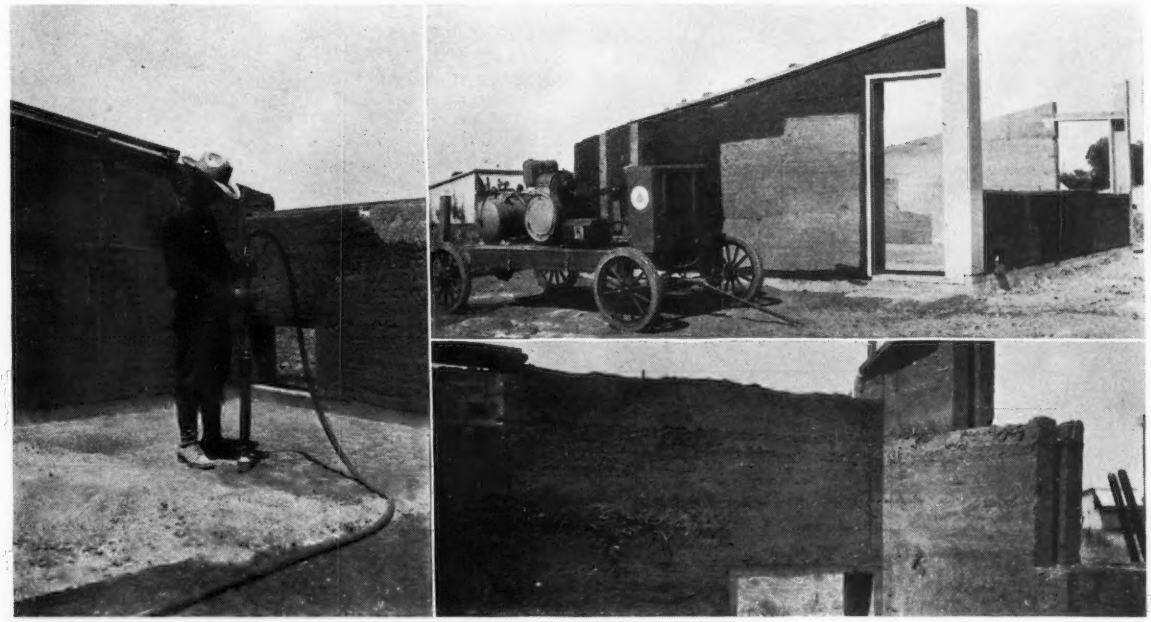
An erection speed of approximately 7 cubic feet of wall per man-hour was obtained, exclusive of the time out to repair a compressor intake valve break and certain delays caused by the experimental nature of the work. A two-man crew was found most efficient, with a third man available to assist in moving the forms.

The compressor equipment has been used approximately 3,000 hours with repairs totaling less than $75.00, according to Mr. Sarver.

The forms used were the same ones described and

[1]A contribution of the Committee on Earth Wall Construction in connection with its 1928 activities.

[2]Junior agricultural engineer, University of California. Assoc. Mem. A.S.A.E.



(Left) Pneumatic tamping tool used for tamping the floor in connection with the experimental work in rammed earth construction at the University of California. (Right, above) The air compressor equipment and completed earth walls. The front wall has been scored and given a coat of tar paint preparatory to stuccoing. (Right, below) A close-up view of the earth wall section containing the straw admixture. The roughness of the surface at the left is due to the roughening of the forms by the tampers

4-inch drain tile. These are arranged as three laterals 15 feet apart. Lateral A was placed about 24 inches under ground, Lateral B about 18 inches deep, and Lateral C at a depth of approximately 15 inches. All lines are laid on a grade of 6 inches per 100 feet. The absorption field is planted to alfalfa. Examination of the tile 28 months after installation indicates there has been no tendency for the roots to enter the tile.

The system was put into operation July 16, 1926. The investigational work on this system extends over a period from August 30, 1926 to March 18, 1928.

EDITOR'S NOTE: This is the first of three installments of this paper by H. B. Walker and R. H. Driftmier. The second and third installments will appear in the September and October issues, respectively.

Terminology in Earth Wall Construction

By J. D. Long[1]

SOIL has been and is being used in various parts of the United States in erecting small structures. Such use is for floors, as a structurally inert insulating material over ceilings, as a roofing, and especially as a material for walls. This terminology is concerned with the various methods of wall construction; in it an attempt has been made to define the methods under the simple, readily understood, English terms which are already more or less widely applied and so do away with the confusion which now exists due to the use (and misuse) of some foreign terms.

The methods of incorporating earth into walls may be listed under five general heads: Sun-dried brick, rammed earth, poured earth, mud-walling and earth filler walls. These names are not as distinctive and self-explanatory as might be desired and afford opportunity for improvement, but it is believed that they are preferable to some of the obsolete and arbitrarily derived foreign terms which have been commonly used in describing this work. The description of each method follows; it will be noted that each provides for a thorough working or "puddling" of the soil in a damp or wet state before or as it is being worked into the wall.

Sun-Dried Brick, frequently termed "adobe" or "adobe brick," are regular-shaped blocks of well-mixed mud, which have subsequently been dried in the sun. Short lengths, up to 6 inches, of straw or other vegetable fiber is usually, although not always necessarily added to the mud. The bricks are commonly 4 or 6 inches thick and from 8 to 30 inches in their other dimensions; a common size for a bearing wall is 4x12x18 inches which contains a volume of ½ cubic foot and weighs approximately 45 to 50 pounds. The brick are laid in a wall similar to the laying of ordinary burned brick. A mud mortar is commonly used, although lime or cement mortars may be used. Integral reinforcements may be placed as the walls are built.

Much confusion exists regarding the use of the word "adobe" in connection with this form of building. "Adobe" is a Spanish-Mexican word meaning sun-dried brick; "adobero" from the same source means to mix or puddle. For some unexplained reason soil surveyors and pedologists have adopted the term "adobe" to define "a soil which on drying cracks and breaks into irregular but roughly cubical blocks. . . . . Adobe soils are usually heavy textured and high in content of colloidal clay." Due to the fact that such soils are difficult or impossible to use in any method of earth wall construction without an admixture of some lighter soil or gravel, care should be exercised in using the term "adobe" in connection with earth wall construction.

Rammed Earth, or "pise' de terre," as it has been known in French, is a method consisting of tamping damp soil between forms to make a monolithic wall. Straw or other vegetable binder has not customarily been included with the soil, but integral metallic reinforcement is sometimes recommended. Unit farm pannels are customary, and the wall is erected in successive courses. A four-inch thick layer of loose soil is spread in the form and tamped; it will compact to approximately two and one-half inches. This routine is continued until the two-foot high form is full; the form is then removed and set up on another section of wall. Forming blocks of rammed earth to be laid up in a wall similar to sun-dried brick or precast concrete blocks has not proven as successful as the monolithic rammed earth method. Tamping by hand has been the universal practice in the past but in a few modern examples of this style of building pneumatic tampers have been used.

Poured Earth, or "mud concrete," is a method consisting of pouring a well-mixed mud between forms, much as portland cement concrete is poured. Pouring continuous courses about the wall six to twelve inches deep appears to be the most successful practice although walls nine feet high have been successfully erected at one pouring. Straw or other vegetable binder has not customarily been used.

Mud Walling, or "cob," consists of piling stiff mud, in which straw has been mixed, along the wall in courses. Forms are not used. Forks full of the prepared mud are dropped compactly in place around the wall for its full thickness and to heights regulated by the stiffness of the mud. Before the layer is dry the sides are trimmed plumb with a hay knife. As soon as the work already completed has dried sufficiently hard to support a load another course is added, the process being repeated until the wall stands at the desired height.

Earth Filler Walls, variously known as "half timber," "terra armada" and "binding work," include any method whereby a skeleton structural frame work is erected of other material and puddled soil used to form the filler walls between the frame members. In this country wood timbers have usually formed the framework and sun-dried brick or poured earth the filler walls. This method is the only one wherein the earth wall itself does not support the roof load.

There are deviations from these briefly described methods, but it is believed that these five are the general types to be found. It will be readily perceived that they differ in forming bearing or filler walls, in the methods of puddling the soil; in the amounts of water used in the soil, in the use of straw or other integral reinforcement, in the use and type of forms, in the size of working crew most efficient, and very probably in the soil type most suitable for use with each method and the climate most favorable to each form of construction.

If interest in the subject of earth wall building continues, it would appear necessary to have a logical division of the work into named methods that progress in experimentation and education may progress without confusion.

[1]Junior agricultural engineer, University of California. Assoc. Mem. A.S.A.E.

Pneumatic Tamping in Rammed Earth Wall Construction[1]

By J. D. Long[2]

A PORTABLE air compressor and tamper were borrowed for this phase of the experimental work in progress at University Farm (University of California) at Davis from the Sacramento Division, Pacific Telephone and Telegraph Company, through the courtesy of C. L. Sarver, division plant methods engineer. It consisted of a 7½-hp. New-Way single-cylinder, air-cooled gas engine; a belt-driven, two-cylinder, No. 62 (3x4-inch) Kellogg compressor; and a 30-gallon Kellogg air tank. This equipment, together with convenient cases for hose, tools and supplies, was mounted on a Ford chassis. The tamping tool used was a product of the Chicago Pneumatic Tool Company and was rated to use 20 cubic feet of air per minute at 75 to 80 pounds pressure.

Two tamping heads were used. One was a cylindrical 3-inch (diameter), hollow, cast head with a slightly concave tamping face provided as standard equipment. The other was a head built up for this experiment and had a wedge-shaped tamping face, the two sides forming a 90-degree angle. In use the latter was found to tend to throw the soil out at the sides and so require a longer time to consolidate the soil layer. Since the compacted layers appeared about equally dense the flat-faced tamper was used for the major portion of the work.

Only three difficulties, all of minor importance, were experienced in the operation of this equipment. It was found impossible to exactly control the placing tamper so that it roughed up the sides of the forms, particularly as the work came near the top of the forms. Lining the wood forms with sheet metal would probably have over come this difficulty.

The second difficulty was due to the vibration set up in the completed wall by the tamper; in the 12-inch thick walls this was not detrimental, but it was found advisable to hand tamp the first three layers in a new set-up on the 9-inch walls to avoid breaking loose the top layers of the course below. After the bottom three layers had been tamped the pneumatic tamper could again be used without setting up a destructive vibration in the forms.

The third difficulty was the capacity of the compressor. The 7½-hp. engine was not operating the compressor at highest efficiency and over a four to six-minute period the tank pressure would drop below that required to operate the tamper. As the operator was continually shifting about in the form and giving the equipment brief rest periods to build up a pressure head the actual loss of working efficiency was slight.

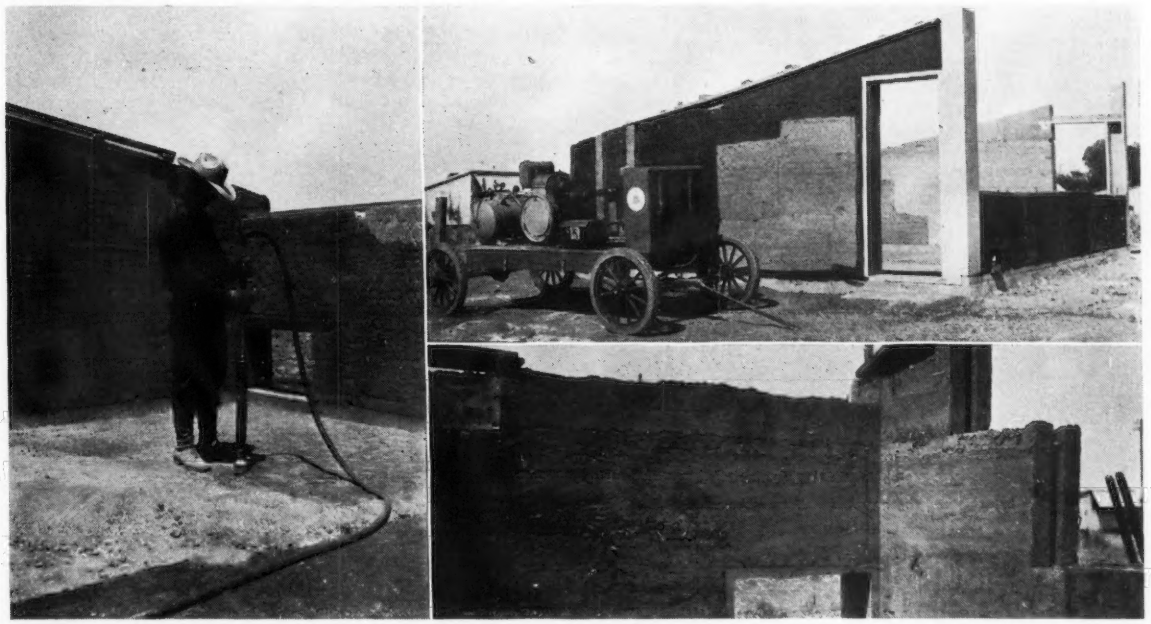
An erection speed of approximately 7 cubic feet of wall per man-hour was obtained, exclusive of the time out to repair a compressor intake valve break and certain delays caused by the experimental nature of the work. A two-man crew was found most efficient, with a third man available to assist in moving the forms.

The compressor equipment has been used approximately 3,000 hours with repairs totaling less than $75.00, according to Mr. Sarver.

The forms used were the same ones described and

[1]A contribution of the Committee on Earth Wall Construction in connection with its 1928 activities.

[2]Junior agricultural engineer, University of California. Assoc. Mem. A.S.A.E.



(Left) Pneumatic tamping tool used for tamping the floor in connection with the experimental work in rammed earth construction at the University of California. (Right, above) The air compressor equipment and completed earth walls. The front wall has been scored and given a coat of tar paint preparatory to stuccoing. (Right, below) A close-up view of the earth wall section containing the straw admixture. The roughness of the surface at the left is due to the roughening of the forms by the tampers

illustrated in the 1927 report of the A.S.A.E. Committee on Earth Wall Construction.

Yolo loam soil, a fine-grained alluvial soil high in colloidal content, was used. It was screened through a ½-inch-mesh screen and used with a moisture content approximately 12 to 14 per cent of the dry weight. Two admixtures were used in wall volumes each totaling about one-eighth of the whole. Straw was mixed with the soil in a proportion one to six by loose volume measure. Hydrated lime was added in two proportions, one to four and one to eight by volume measure.

The straw admixture was noticeably the more "elastic" and harder to compact. Both the straw and lime admixtures were free of the fine cracks which appeared on the wall surfaces composed of natural soil within three days.

A survey made approximately eleven months after the walls were completed shows eleven cracks in the walls which have opened up one-sixteenth inch or wider. One vertical construction joint between the straw and lime admixtures has opened up one-eighth inch and has a continuing crack extending through the lime admixture above. A similar crack exists between sections of the straw admixture and the natural soil. There are four random cracks and one construction joint in the natural earth wall which have opened one-eighth inch wide and two random cracks and two vertical construction joints have opened one-fourth inch. Most of the cracks extend through only one course in height; only about half are noticeable on both exterior and interior faces. There are no cracks extending through the body of the straw admixture. It is impossible to force a wire through or note an air movement through any of these latter. Turkeys kept in the structure for approximately three months pecked at those cracks within reach from the floor and roost until some cracks are flared to an inch width just at the inner surface of the wall. The Leghorn pullets kept in the house for the past six months have not exhibited this tendency.

One-third of the foundation was covered with a brush coat of asphalt paint, a second third with two thicknesses of three-ply asphalt roll roofing, and the remainder left in the natural state. The foundation is of dense concrete and the top is approximately six inches above grade. No signs of moisture conduction from the foundation into the wall have been noticed.

The south and east walls of the structure have been covered with two coats of cement stucco applied two months after the walls were completed. The south wall (of natural soil) was scored diagonally in both directions with a pick about six inches apart and half an inch deep, given a brush coat of asphalt paint and studded with 8d nails six inches apart and driven in to within one-fourth inch of the head. A proprietary waterproofing stucco was used as the second coat on one half the area. The stucco appears to be loose from the wall over the entire area but is supported by the nails. There are six vertical cracks in the stucco spaced roughly every three feet but there are no signs of water penetrating behind the wall. The stucco on the east wall has two vertical cracks and likewise appears to have loosened from the wall except over a large area of the straw admixture.

The west wall was given one brush coat of asphalt paint (asphalt boiler and stock paint) within two weeks after the wall was completed and two coats of a cream colored lead-and-oil paint within two months. There are three very small areas where a crate dropped against the wall has penetrated the coating; otherwise it appears in excellent condition. The two coats of lead and asphalt paint used were sufficient to cover the color of the asphalt paint.

The north wall, away from the direction of the prevailing storms and protected by a twelve-inch overhang five feet above ground was given a mud plaster coat. Soil and sand proportioned one to two were mixed to a mortar consistency and trowled on the wall about one-half inch thick within a week after the walls were completed. The mud plaster is adhering perfectly to the wall which includes sections of natural soil and both straw and lime admixtures. Three vertical cracks show, all at construction joints. Brush coats of asphalt paint and of lead and oil paint were applied to sections of the mud plaster. Both finishes appear to be in excellent condition. A section of the mud plaster left natural is also in excellent condition except in the first six inches above the foundation where the splash from the ground has washed just enough to be noticeable.

A one-course, cement plaster coat was applied to the rear wall behind the droppings boards. The wall was slightly scored in preparation and the plaster, applied directly to the wall, appears to be adhering perfectly. Two vertical cracks are visible, each appearing over a vertical construction joint.

The front wall was given a brush coat of asphalt paint within two days after erection. The two gable ends were left bare.

An earth floor approximately six inches thick and extending three inches above the outside grade was tamped just after the walls were completed. One-half is composed of a gravel and soil mixture proportioned one to four. And the other half of a lime admixture, proportioned one to eight. Across one-half of each of these sections was spread one coat of asphalt paint. There are no holes in the floor although it was anticipated that there would be. No dampness has been noticeable; rather the floor is objectionable because of the dust which accumulates in the litter.

The rainfall since the structure was erected is some three inches less than our annual average and is as follows: October, 1.71; November, 2.91; December, 2.32; January, 1.73; February, 1.62; March, 3.45; April, 0.75.

Strength Tests of Knots, Hitches and Splices[1]

By J. Grant Dent[2]

WHEN making tensile strength tests of rope, several things must be considered if the results are to be accurate and reliable. The rope for each series should be taken from the same coil; enough tests should be made to give a fair average; the relative humidity of the air in the room where the tests are made must be approximately the same for the entire series of tests; and the speed of the testing machine should be the same for all tests.

In a series of tests at the University of Minnesota[3] one coil each of three and four-strand, one-half-inch manila rope of medium grade was purchased from a wholesale house. Both coils were of the same brand and the quality of fiber appeared to be very similar and about equal in average length.

Ten tests of each kind were decided upon after twenty or more failed to change the average of the first ten materially. However, many of the tests were rechecked with another set of ten for accuracy. These rechecked tests were not entered in the series.

The tests were made during a time when the relative humidity of the air in the room remained approximately the same. Manila rope stored in a steam-heated building where the relative humidity is low (9 or 10 per cent) may lose from 20 to 30 per cent of its strength, as compared to midsummer tests.

A Riehle Brothers 50,000-pound testing machine equipped with a variable speed motor was used. A speed was selected which was fast enough to permit the weighing arm to be easily kept in balance but not fast enough to cause it to bounce. A slow speed of the testing machine is apt to show less strength in the specimen than a fast speed.

Referring to Fig. 1, Columns A and B, it will be noted that the four-strand rope showed slightly more strength than the three-strand. This was also true of two other better-grade brands of rope. The four-strand rope had no core and each strand was composed of 6 yarns making 24 yarns for the rope. The three-strand rope contained 7 yarns in each strand or a total of 21 yarns. A ten-foot length of the four-strand rope weighed 357 grams as compared to 296 grams for the three-strand, or approximately 20 per cent more, although the tensile strength was only slightly greater.

Columns C and D represent the average of ten tests each of the bowline knot. The bowline is often spoken of as the king of knots and rightly so. It forms a loop in the end of a rope which never slips under the most severe strain and is always easily untied. Its strength as compared to the unspliced rope is approximately 60 per cent (See per cent at right of graph). The bowline on a bight (E) is somewhat similar in construction to the bowline but forms a double loop. It is used for foot holds when lowering persons down a cliff, etc., as a sling for sacks or barrels and by firemen for lowering an unconscious or injured person from a burning building. It is safe and always easily untied. Its efficiency is about the same as the bowline.

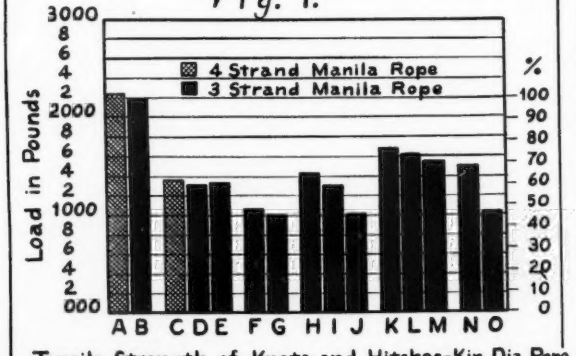
A figure eight (F) is used for a handhold in rope, as a packers knot in tying bundles or roping trunks and on rope handles for a chest or box. It is difficult to untie

[1]First of a series of articles on rope testing. The next of the series will appear in an early issue.

[2]Instructor in agricultural engineering, University of Minnesota. Mem. A.S.A.E.

[3]These tests were made in the agricultural engineering division in 1928, using a Riehle Brothers 50,000-pound testing machine.

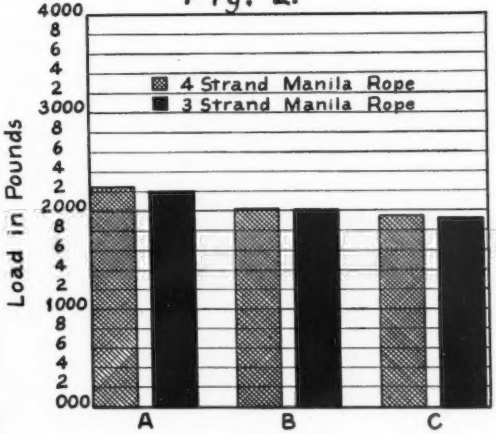
Fig. 1.



Tensile Strength of Knots and Hitches-½in. Dia. Rope

	Rope Strength-lbs.			
A	4 Strand	2260	H Carrick Bend,	1430
B	3 Strand	2200	I Weavers'	1300
			J Square	1010
	Strength of Knots-lbs.		**Strength of Hitches-lbs**	
C	Bowline-4 Strds.	1370	K Double Half	1670
D	" 3 "	1320	L Clove	1620
E	" on a Bight	1350	M Fishermans Bend	1540
F	Figure 8	1070	N Well Pipe	1500
G	Overhand	1000	O Sheep Shank	1040

Fig. 2.



Strength Tests of Splices - ½ in. Dia. Rope

	Brand	Average lbs. 4 Strds.	Average lbs. 3 Strds.	% Efficiency 4 Strds.	% Efficiency 3 Strds.
A Unspliced Rope	A	2260	2200	100%	100%
B Short Splice	A	2020	2010	89%	90%
C Long Splice	A	1950	1920	86%	87%

after a very hard pull and the efficiency is low, approximately 48 per cent.

The overhand (G) is the simplest of knots and is a part of many other knots. It often gets tied accidentally in a rope or clothes line and is very difficult to untie after a heavy pull. Its efficiency is approximately 45 per cent.

A carrick bend (H) is used for tying two ropes together for a heavy pull and should always have a block of wood or similar object inserted in the diamond-shaped opening in the center. It never slips, will actually fail apart after the heaviest pull and has an efficiency of about 65 per cent.

The weaver's knot (I) is used for tying ropes or cords together. It is rather difficult to untie after a heavy pull. Where a small rope is to be tied to a large one it is especially valuable. Its efficiency is approximately 60 per cent.

The square knot (J) is the most common of the knots for tying two ropes or cords together. It is difficult to untie after a heavy pull and has an efficiency of only 45 per cent.

The double half-hitch (K) is a general-purpose hitch which is always safe. It is sometimes difficult to untie but has a high efficiency, approximately 76 per cent.

A clove hitch (L) will occasionally slip some under a very heavy pull. It is used mostly for tying up boats, for tent ropes and, to some extent, for a sack tie. Its efficiency is approximately 74 per cent.

The fishermen's bend (M) is one of the safest and most valuable of the hitches. It is used as a general-purpose hitch, for fastening a rope on an anchor, ring, clevis or hook, and for fastening a line on a fish hook. It is always easily untied and has an efficiency of about 70 per cent.

The well-pipe hitch (N) is used for pulling pipes from a well. Its efficiency is approximately 68 per cent.

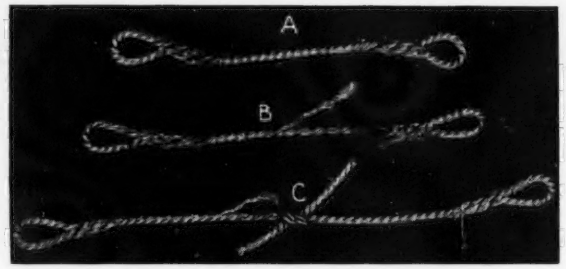
A sheep shank (O) is used for temporarily shortening a rope and for taking up slack in an electric light drop cord. Its efficiency is about 47 per cent.

Fig 2 compares the spliced rope with the unspliced. The rope used was the same as in Fig. 1. Even a perfect splice will usually weaken the rope somewhat, although the break will not occur in the splice itself. It will usually be near one end of the short splice and near one of the sections of the long splice. The short splice should be used for joining two ropes when not expected to run through pulleys while the long splice is especially for pulley work.

Note the difference in strength efficiency between the square knot, which is often used in a hay fork outfit with a knot-passing pulley, and the long splice; 45 per cent efficiency for the knot as compared to 87 per cent for the splice.

SUMMARY

In the foregoing tests the eye splice was used for securing the ends of the rope over a ¾-inch gas pipe. Approximately 90 per cent of the breaks in the unspliced rope were in the straight part near or at the end of the splicing which formed the eye. This would indicate that the spliced eye weakens the rope slightly, although less than any other form of fastening. It is the standard method used for rope testing. In the spliced eye the strands of the rope are spread slightly by the loose ends being wrapped around them, probably throwing a slightly greater strain there, and causing the rope to fail at that point. In making the eye each loose strand was given two complete turns around a strand in the rope. The ends were than cut off. Approximately 2,000 spliced eyes have been used in this and other series of rope tests during the past year as well as a great many in former years and in no case has one pulled out or broken in the loop or splice itself, except in cotton rope when the failure is sometimes in the eye due to kinking of the strands.



"A" shows a specimen ready for the testing machine. Typical failures are shown in "B" and "C"; failure at a knot usually occurs in the straight rope, which is sheared off by the bend of the knot

In about 90 per cent of the specimens one strand breaks first. When a knot is tied in the rope the failure is always at the knot, usually one strand first (Fig. 3). It is interesting to note that the break does not occur in the bend of the rope within the body of the knot as one might suppose, but in the straight rope at one end of the knot where it is encircled and sheared off by the part forming the knot.

The longest piece of fiber found in the four-strand rope was 7 feet. The average length of 300 fibers was about 3½ feet. In the three-strand rope, the longest fiber measured 6 feet and the average length was 3 feet.

In a series of tests made several years ago the testing was spread throughout the year and the relative humidity of the air and the corresponding moisture content of the rope were not taken into consideration. The results found at that time do not in all cases correspond with those of the tests reported here.

A Table of Knot and Splice Efficiency

Knot or Splice	Approximate per cent efficiency as compared to unspliced rope
Unspliced (Using eye splice for securing)	100
Short splice	90
Long splice	87
Bowline	60
Bowline on a bight	61
Figure eight	48
Overhand	45
Carrick bend	65
Weaver's knot	60
Square	45
Double half-hitch	76
Clove hitch	74
Fisherman's bend	70
Well-pipe hitch	68
Sheep shank	47

"Engineer" Defined

REPRESENTATIVES of four leading engineering societies recently met in conference to discuss the terms "engineer" and "engineman" for the purpose of preparing a statement of not over fifty words which could be submitted to the Bureau of Census as a guide for the census enumerator to decide upon the proper designation of those who might claim to be engineers. The following statement was agreed upon:

"An engineer is a man or woman of professional training or experience who applies engineering principles to research, design, construction, operation or production, or who imparts technical instruction in these fields. The professional engineer must be carefully differentiated from the machine or engine operator."

Agricultural Engineering Advertising

By D. B. Lucas[1]

"WE want you to sign a contract to have your house and barn wired," continued Mr. Watt after the exchange of a few introductory remarks with Mr. Farmer, in whose dooryard the disastrous transaction was nearing an early climax.

"When can you do the job?" returns the typical Mr. John Farmer, who assumes and fully believes that his new friends are representatives of one of the big central electric corporations.

"We will have our men on your place within a week," reassures the kindly Mr. Watt, and his associate, Mr. Volt, adds a little pressure by a smiling "or sooner."

"Just what will the work cost me?" apologies Mr. Farmer, feeling that the question is almost unnecessary since these fine fellows are certainly looking out for his interests and will make the price fair.

"Oh, you don't need to worry about that now," cuts off the fully prepared Mr. Watt. "You don't pay a cent until the job is done and the lights have been turned on. We aren't in any hurry for the money so we will just date this paper (What paper? It is a promissory note!) next March 31, and you can then pay us $346.00 if the wiring is satisfactory."

"Let's see," ponders Mr. Farmer, "That is a lot of money. Maybe I had better think this thing over for a day."

But right there Mr. Farmer was mistaken. Messrs. Watt and Volt explained that the whole new expansion depended upon his own job, that his neighbors could not have service without him, and that a delay now might mean twenty more years of the old kerosene lamp.

And so the contract was signed, and to exceed expectations, the wiring was actually in progress within two days. With remarkable speed the job was finished. Yes, Mr. Brown on the south and Mr. Jones to the west had signed too. Then weeks of silence and March 31 with responsibilities to a finance company who now owned the note. And light was not coming and would not come so far as any local power company knew.

John Farmer had sized up a situation on assumptions instead of facts. Mr. Watt's wiring company had nothing whatever to do with the power corporations. John Farmer had signed an important deal with a total stranger. And to add insult to injury, appraisal of the wiring job by an expert later revealed that a first-class price had been paid for any old thing what would pass inspection. No doubt it was a long time before Mr. Farmer could look into his shaving mirror without at least thinking, "Hello, you old sucker." Is this the sort of a customer the rural advertiser has to deal with?

Now for the mistakes of the wiring company with such unscrupulous methods. Their mistake was essentially the breaking off of relations with Mr. Honesty in Business. In the first place honesty is right, and may divine guidance keep that reason sufficient for all time. Secondly, honesty is and always will be the best policy. No doubt many of the schemers realize a profit for a while, but usually their prosperity is short. And what of the general loss of confidence suffered by business as a whole due to a few such deals? Wherever business morals or business policies are at stake, it is up to business as a whole to restrict the irregular minorities. The first item for the advertiser to strike off from his list of sales instruments is intentional deceit. In the same category comes the axiom: "Do not oversell the unwise customer." For every gullible man who is trapped there is a whole neighborhood ready to profit by his mistake and resist sales to the limit. Today, more than ever before, the advertiser wants a regular customer instead of a hurried, perhaps ill-considered sale.

Fortunately there is a growing body of evidence to show that the great American buying public is far more intelligent than the advertiser usually assumes. The editor of a prominent sales magazine recently stated that we have been far too conservative in our estimates of the reasoning powers of the readers of advertisements. An interesting proof is seen in Henry Ford's admirable advertising campaign in recent months. It looks as though Mr. Ford believes in placing sales arguments on a strictly clear and logical basis. It also seems that Mr. Ford refused to advertise until he was able to secure the services of an agency that would talk plainly to his customers. An appeal to intelligence, not overdrawn to the extreme, may be very effective in selling. The buying public has the intelligence to discriminate, but the advertiser should never forget that decision is based on an emotion which is only partially aroused through logical reasons.

It has been demonstrated beyond question that belief (and the resulting decision, perhaps to buy) is largely an emotional state. The new salesman who starts out cocksure because he has waterproof arguments is due for a severe shock. He will stand aghast as his customer assents to the truth of all that he says, and then flatly turns him down. Ask the reason and the reply comes, "You have a good proposition but I don't feel like buying right now." Just as a tip I would suggest that I don't know of any better way to turn down a persistent agent. If you agree with all he says, what more can he say? From the salesman's standpoint, he has built up the reasoning appeal while failing to arouse the proper emotional setting. Reasons alone cannot win sales. Appeals to the feelings will get only a certain emotionally governed group. Successful selling demands the coordination of thought and feeling.

In addition to the intellectual and emotional influences there remains one other major factor in causing the customer to believe and act as he does. A trunk manufacturer raised considerable doubt in the minds of an advertising test group by printing a startling, though genuine and well-vouched for photograph. The photograph showed a five-ton elephant standing on a trunk. In contrast, a razor advertisement using the terms, "fulcrum shoulder," "channeled guard," "micrometric precision," and "major" and "minor flexure" won the unanimous belief of a similar test group. In the latter case not one of the group could bring reason to support his belief but the razor arguments seemed much more possible than the trunk picture. The point is that if you want to make a customer accept something that conflicts with what he already believes, you had best take the evidence to him in person and be prepared to stay as long as necessary. Avoid conflict with his established habits of thought. Habit is a tremendous factor in the forming of opinions. Always build upon the reader's experience. The advertiser should not lose sight of the fact that about 90 per cent of his readers vote and worship as did their fathers. In fact we all might improve our repertoire of principles, if we should take an inventory and discover how many of our tenets arise from actual fact.

There are certain general aspects of the science of

---

[1]Assistant professor of agricultural engineering, Rutgers University. Assoc. Mem. A.S.A.E.

(Editor's Note: The author has a master's degree in agricultural engineering and a Ph. D. degree in the psychology of advertising.)

advertising which are of interest to a preliminary discussion such as this. One of the hardest jobs the advertising copy writer faces is that of making the reader think of the goods instead of the advertisement. It is not the symbol but the product symbolized that is to be sold. Recently a copy writer in a leading advertising agency told me of an experience with a representative of a large telephone company. The latter was making a mild complaint that his advertisements were not being seen. He said that he took a boat trip abroad shortly after the appearance of an advertisement of the new transoceanic telephone service. A fellow passenger was seen to thumb through the magazine in which the advertisement was carried. Later the telephone representative approached his fellow traveler and asked, "Did you see our advertisement for the new transoceanic telephone service?" The reply came. "No, but I know something about it," and the gentleman proceeded to tell many details which had been released to the public in that very piece of copy. The complaint made to the advertising agency was that the public was not seeing the advertisements as was indicated by this one negative reply. The agency claimed, and quite justly, that they had been unusually successful for they had shown the goods effectively to the exclusion of the symbol used. People were learning about transoceanic telephone service through the advertisements, while not overcrowding their memories with the pretty colors, or the interesting photograph carried in the magazine display.

There is a tendency for salesmen to be timid in approaching rural customers if their own farm experience is limited. The salesman feels that he should know all about the farming business in order to do the most effective job. Then there is the tractor manufacturer who insists that his salesmen must be technical experts on tractors. The manufacturer wants a tractor expert with a farm background to manage his sales. He is right. The ideal farm tractor salesman is a good salesman and in addition knows farming, farmers and tractors thoroughly. A leading advertisers' periodical carries a story which says that the ideal saleman is one of those rare gems who is a technical genius and a thorough born salesman. But the trouble is that the gems are rare and sales forces cannot easily be built from such splendid material. The technical man is noted, perhaps justly, for his social and psychological shortcomings. He rarely talks the consumers' language which is the first requirement of the advertiser or seller. Selling organizations must be built from the material available.

Within the last six months an advertising copy writer, a sales manager and an advertising periodical editor have all told me that a salesman should not know too much about his product. I could not agree to the statement as expressed, but from the psychological standpoint the underlying meaning is probably true. The technical man tends to lay the emphasis on honest aspects of construction or perhaps manufacture. But the buyer is thinking chiefly of the goods as they relate to him, his family or those for whom he is responsible. The advertiser or salesman must first be an artist in human relationships. Then if he can add to his abilities a thorough knowledge of the product he is selling he is equipped to attain all that the customer world has to offer.

Men with good sales possibilities frequently hesitate to enter into that field because they believe the public is already oversold. This argument is not consistent with the past experiences of American business. It is the occasional individual who is oversold, unfortunately for himself and those who deal with him thereafter. Attention is frequently called to the stupendous sum of $1,500,000,000 handled annually by professional advertising agencies alone, as an indication of waste in business. The contrary is more nearly true. The increase in efficiency, both in manufacturing and distributing, which accompanies effective national advertising compensates many times over for the publicity investment. The managing editor of a prominent advertising periodical stated only last month that the advertising profession is just beginning to realize the tremendous buying power of the public. We have long since passed the day when a want was a necessity of life. Most wants today, as indicated by the goods they demand, are more truly an indication of the public desire not merely to live, but to live wholesomely. Few people need a radio, but a magnificent contribution has been made to the lives of the mass through this instrument. Ralph A. Palmer recently stated that the way "To produce greater prosperity is to increase economic consumption, ..." and this can be done by, "Discovering new wants that can be satisfied with present commodities or with new commodities which might be produced." He adds, "You can apply engineering to agriculture in any way that promotes efficiency or the satisfaction of new economic wants and be sure you are going ahead." Then, as agricultural engineering grows, and is accompanied by the resultant increase in agricultural prosperity and development, agricultural engineering advertising must keep the pace.

Utilizing Farm Wastes

THE problem of farm surpluses is now being attacked by researchers in three ways: First, by preserving the surplus products of the farms for future use; second, by converting the product in such manner that it may be taken out of its field of unsuccessful competition and thrown into another field; and third, through manufacturing farm products by such processes as will convert them to other uses than food.

The increasingly successful conversion of the residues and surplus of the corn crop into such products as starch, glucose, ethyl alcohol, butyl alcohol, and acetone marks a field in which such articles find ever widening markets which do not compete with corn itself. The manufacture of sugar-cane bagasse into fiber board affords another example of successful conversion of farm wastes into commercial products on a large scale.

So important have the potential uses of these farm wastes become that the Bureau of Chemistry and Soils has made a careful accounting of our National supply which shows there is an annual production in the United States of about 100,000,000 tons of cornstalks, 115,000,000 tons of cereal straws, 20,000,000 tons of corncobs, 3,000,000 tons of oat hulls, 18,000,000 tons of cotton stalks, 1,800,000 tons of cottonseed hulls, 2,200,000 tons of flax straw, 70,000 tons of peanut hulls, and 500,000 tons of sugarcane bagasse, making a grand total of 260,570,000 tons of agricultural wastes and residues for which little use has been found.

This great annual store of material challenges the best talent of the country to perfect its utilization and therein lies one important means for the solution of the so-called farm problem. On the other hand, in helping one class of farmers to use their products another line of farm products may be seriously disturbed, as evidenced by the present influence which cottonseed oil exerts on the market for other fats and oils.

In spite of the economic obstacles which hitherto have retarded large-scale manufacture of farm by-products, the rapidly increasing success of this new type of manufacturing and the use of increasingly large quantities of farm-waste materials will bring about improvement in the balance between farm and factory and will mean a healthier economic condition for the American farmer.—Dr. Henry G. Knight, chief of the Bureau of Chemistry and Soils, U. S. Department of Agriculture.

The Design and Construction of the Electric Brooder[1]

By A. R. Wood[2]

I KNOW of no better manner in which to present this subject than to give an historic account of our own experience in the development of the radiant type brooder. Being manufacturers of incubators, we felt that brooders offered the next most logical step for the expansion of our business. The first question was, What kind of brooders should we build—coal-burning, oil-burning or electric? Perhaps eventually we might build a complete line of them, but we wanted to start with but one kind of brooder. Being located on the Pacific Coast, where climatic conditions are comparatively mild and where there is an abundance of cheap, dependable electric current, we were impressed with the possibilities of the electric brooder.

We bought a number of brooders which were already on the market, studied carefully their construction and learned as much as possible from the users about their desirable as well as their undesirable points. We found that the most common and probably the most satisfactory type of electric brooder on the market was the convection type, a cone-shaped, galvanized iron hover which had heating elements mounted upon a flat piece of insulating material attached inside of the hover about 12 inches above the floor. These heating elements were non-glowing spiral coils of resistance wire, supported on porcelain insulators controlled by a thermostat. This type of brooder had a number of good points.

In the first place, it was very economical to operate. The heating elements were comparatively close to the floor and the brooder proper was well insulated so as to maintain the heat uniformly with very little loss through convection. Additional conservation of the heat was made possible by the use of a curtain, or, in some cases, two curtains between the bottom of the hover and the floor. These curtains kept out room cross draughts and floor draughts. Most of these brooders were provided with a means of ventilation through the top of the hover which could be manually controlled according to the requirements.

The main objection to this type of brooder was that there was not sufficient heat to facilitate ventilation. This frequently resulted in the chicks sweating and created an unhealthful condition under the hover.

Another type of brooder we studied was what is known as the underheat electric brooder. This brooder uses both convection and the conduction principle of heating. It usually consists of a box 4 to 6 inches deep, about 4 feet wide and 7 feet long, raised a few inches above the ground, or above the floor. In the space between the bottom of the box and the floor are the heating elements, non-glowing, spiral coils of resistance wire controlled by a thermostat in the chamber above. The box proper is filled with sand to a depth of three or four inches. Passing through the bottom of the box, spaced about two feet apart, are vent pipes 2 inches in diameter which carry the warm air from the element chamber underneath the box to the nursery above the sand. Above the sand a few inches is a top for keeping off room draughts and holding in the heat. The heating elements, being underneath the box, thoroughly warm the sand and help to stabilize the temperature. This brooder we found to be very economical in operation. It seemed to meet every requirement of a brooder as to heat and ventilating conditions.

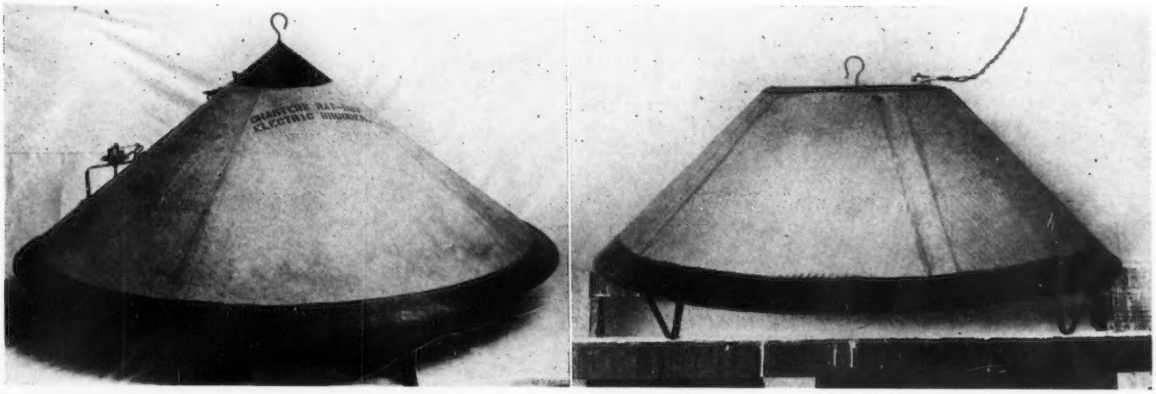
Against these advantages were the facts that the brooder was clumsy and heavy, was not portable, and could not be thoroughly cleaned except by removing the entire layer of sand and replacing it. It was not a practical type of brooder to manufacture on a production basis.

We learned of a man who had built a radiant type brooder of his own and was using it with considerable success. He had disclosed his plan to a neighbor who had also built a radiant type brooder, and had unusually good success with it. It was crudely made and had no thermostatic control, but nevertheless seemed to give results. We obtained the plans and built a few of these brooders, one of which we sent to the University of California, College of Agriculture, at Davis, for testing. We also put a number out for local poultry raisers to test.

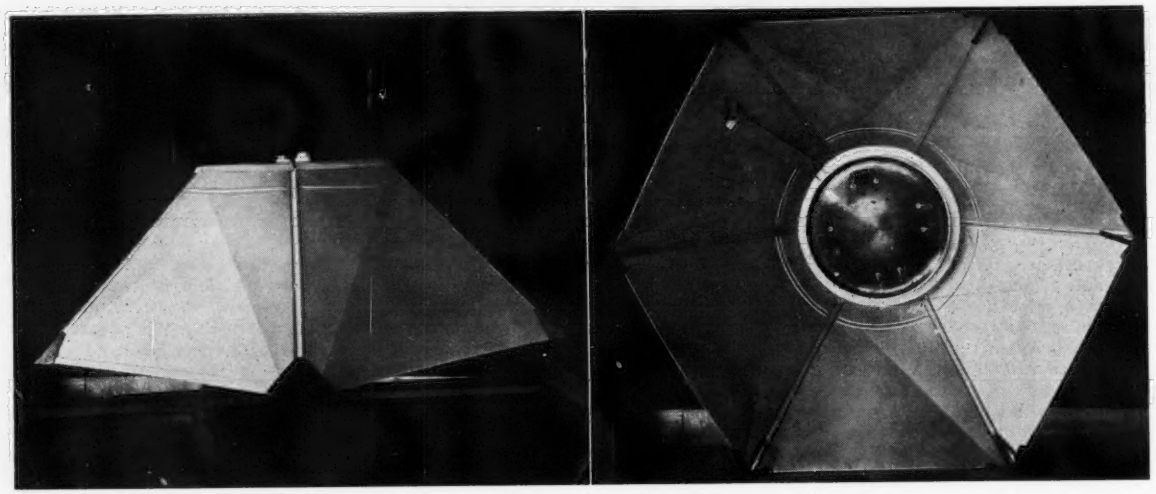
The first brooders we built, it goes without saying, were not works of beauty or mechanical perfection. The hover was a plain cone of galvanized iron, about 60 inches in diameter at the bottom, coming to a point about 30 inches above the floor, with a hook on the top for suspending by a cord. The heating arrangement was an inverted

[1]Paper presented at a meeting of the Pacific Coast Section of the American Society of Agricultural Engineers, at Ontario, Calif., April, 1929.

[2]Wood Brothers Co. Assoc. Mem. A.S.A.E.



(Left) Old style electric brooder with pointed cone and asbestos covering. (Right) A truncated cone brooder, the next step in development



(Left) An outside view of the truncated hexagon brooder developed as an improvement on the truncated cone brooder. (Right) Interior or bottom of this brooder showing thermostat, door and convex spun-copper reflector with heating element

galvanized iron cone which had two ordinary porcelain sign sockets attached, one on either side of it, underneath the hover. These sign sockets were placed about 12 inches apart and accommodated a standard type of glowing element such as is used in the ordinary copper reflector type of portable heater. When we placed one of these brooders in actual operation we found that the heat was too concentrated, the coils were too bright, and that if we were to maintain the temperature at all uniform it would be necessary to use a thermostatic control. We also found that the galvanized iron inverted cone was not the best kind of a reflector.

With the ideas which we received from our coworkers at Davis, and the facts which we had discovered through our own experimenting, we went back to the bench and built a few more radiant heat brooders. We adopted a copper cone reflector in place of the galvanized iron one and made the cone very flat. We used four sign sockets instead of two, providing four heating elements which we connected in pairs so that the two opposite each other turned on and off together. We connected these elements in series instead of parallel, which reduced the glow to a desired degree and distributed the heat under the hover more uniformly. We attached only one pair of these elements to the thermostat control, connecting the other two so that they were heating during the entire time the brooder was connected.

This brooder proved much more satisfactory so far as the distribution and uniformity of the heat were concerned, but there still remained many objections to be overcome. We were losing too much heat. The entire outside of the hover got so hot one would not dare touch it. The heat was not distributed as evenly under the hover as it should have been and, after the heating elements had been burning in the socket for some time, the heat softened the metal parts in the socket, causing the electrical connection to the elements to fail. All of these conditions had to be overcome before we could expect any success to attend our efforts.

So we designed and developed a new element which entirely eliminated the socket, and which could under no circumstances become disconnected as long as the current was delivered to the brooder. We discarded the conical, copper diaphram deflector for a convex, spun copper reflector, built upon a more scientific basis. We covered the entire outside of the hover with asbestos which we cemented in place on the galvanized iron with sodium silicate. The new diaphram which we had obtained for the brooder was considerably larger in diameter than the cone which we had discarded. The proper distance for the reflector above the floor we found to be approximately 24 inches, and if we were to retain the width of the hover at the bottom at 60 inches and place a diaphram 24 inches in diameter two feet above the floor, we saw it was going to make our brooder hover very high if we continued the cone to a point. To avoid this unnecessary waste of sheet metal, which would be required to form the top part of the cone of the hover above the diaphram, we simply left this part of the brooder off and made the top flat, cutting the brooder off just above the diaphram and putting a sheet metal top on it. We also provided a manually controlled switch to turn off the two elements which were not connected to the thermostat, so that in case of hot weather these two elements not connected to the thermostat could be cut out.

While we were working out these developments we were receiving a good many orders for our brooders and shipping them out as fast as we could make them. In a few weeks we began to get reports on the brooders. One of our customers who lives in our immediate territory, called up one morning and asked us to come out and look at his brooder. We asked him what the trouble was. He insisted we come out and look at it. We went and found that the four-weeks-old chicks had eaten off every bit of the corrugated asbestos around the bottom rim of the hover up as high as they could reach.

Here was a problem. It seemed essential that we use asbestos for insulating our brooders against loss of heat. On close examination we found that the chicks had not eaten the asbestos around some black lettering on the bottom rim of the brooder. This gave us an idea. We painted the lower part of the rim of the hover about 8 inches up with a heavy black lacquer, and after that had very little trouble from the chicks eating off insulation, except where paint became scraped off. We felt that if we could make the insulation on the brooder more permanent it would be to our advantage, both for shipping and handling. Insulating engineers recommended using a vitrobestos cement over the asbestos, on top of which we applied one thickness of cheesecloth or gauze and another coat of this vitrobestos cement outside.

The cement permeated the corrugated asbestos fibre, as well as the cheesecloth outside of it, and formed a surprisingly hard, rigid surface. At last we had a solution to our insulating problems, and turned out all our brooders

using this treatment of vitrobestos cement and cheesecloth on the outside of the galvanized iron hover.

In examining some of the brooders treated with this new insulating material, we found that the heat near the top of the brooder dried all the moisture out of the cement and asbestos and split the outside covering, cheesecloth and all, wide open. Something stronger than cheesecloth must be used, so we decided to use burlap. We found this met the requirements.

As we watched these brooders leave our plant, and as we observed and studied them in operation, we felt that the insulation which we had on the hover, arranged as we had it, was still not a sufficient protection against the loss of heat. The upper part of the hover became so hot that one could not hold his hand against it, even though it was covered with insulation. We prepared to run some long and careful experiments on heat.

Obtaining two very carefully calibrated current consumption meters, we made up some heating elements, tested them carefully as to amperage and glow, and built two brooders—one just the same as we had been building for our trade and another one without any asbestos on the outside of the hover, but with the inside copper diaphram suspended below the top of the brooder about two inches. We found the brooder with the suspended diaphram radiated more heat to the floor, while the temperature of the metal top of the brooder was considerably lower than the top of the brooder which had been insulated with our asbestos cement treatment. The fact of the matter was we discovered that we were losing the heat in our standard brooder entirely by conduction. The copper diaphram reflector being in direct contact with the metal top carried the heat away. When the copper diaphram reflector was suspended inside of the hover, the only heat that could be conducted away by metal contact was through the three suspending bolts. Carrying our experiment still further, we found that by putting a pad of corrugated asbestos, approximately two inches thick, immediately above the copper diaphram reflector, between it and the top, we cut the heat loss down to a point where it was almost a negligible quantity.

On the face of it, it would appear that the reflecting quality of the copper diaphram reflector would be the same whether the reflector was hot or whether it was cold. However, our experiments proved this not to be the case. We found that when the reflector was suspended and insulated from any other metal parts of the brooder by a heavy asbestos insulation, it reflected a greater percentage of heat towards the floor. More careful experimenting showed the insulating value of asbestos placed on the outside of the hover proper to be negligible.

Another problem. Few brooder house doors would accommodate our 1000-chick brooders, which is 88 inches in diameter. A poultryman would order one and find that he would have to tear down his brooder house to get it inside. Not only that, but when people ordered our brooder from any distance the freight was high and handling awkward because it was so bulky when crated set up. One of our large brooders took a ton rate because it occupied approximately 40 cubic feet of space, yet it actually weighed crated not more than 250 pounds.

To nest these brooders one on top of the other was out of the question. There seemed to be only one way out, to develop a knocked-down brooder. We made the hover proper in four sections of equal size, joined them together with bolts and put feet at each joint. Up to this time we had been supporting the lower rim of the hover by using a quarter-inch wire turned in to the sheet metal. This made a rigid rim and gave a good appearance, but when it was necessary to break the wire in four places it weakened the supports of each segment so much that they sagged badly. There were two solutions. One was to put a foot in the center of each segment. The other was to make more segments. We made up a knocked-down brooder using six segments in the hover instead of four. This made a much better hover, but still the segments were a little weak in the center and butting the ends of the wire together at the bottom where the segments joined was not satisfactory.

It was also a difficult problem to cut the outside radius of each segment uniformly in the circle shears, and turning a groove in the bottom of the segment to accommodate the stiffening wire was slow work. If we could cut the bottom of the segment off straight instead of on a radius, and fold the metal itself in such a way as to form the stiffening member, it would simplify matters tremendously. We built a brooder on these lines with the segments straight across the bottom but rounded at the top. A triangular metal plate at the bottom of each segment joint provided a solid member to which we attached the brooder foot. This construction was ideal from the standpoint of production in quantity, as well as from a purely mechanical standpoint and offered absolutely no objections as far as the requirements of the brooder itself were concerned. It is used in our present output of brooders.

The average poultryman who buys some resistance wire, porcelain knobs, asbestos insulation and a switch, a lamp socket and a thermostat control, some sheet steel or galvanized iron and some lumber to make a brooder starts at exactly the same place we started, or at which any manufacturer of brooders has to start to develop his product. Of course, he has the advantage of seeing the brooders which are already constructed. So did we. We observed the details and design of brooders which were on the market. But as sure as he starts out to build his brooder, he will find some details which he overlooked.

Before the average poultryman gets through building his homemade brooder, he is more often than not, out more money through loss of time, loss of chicks and loss of patience, than half a dozen of the best brooders on the market would cost him. This observation is by no means limited to brooders either.

To Market by Air!

THAT is the message used by the students of the agricultural engineering division of the University of California on their float in the Picnic Day parade April 20. The plane, shown in the picture, carried several chickens, a pig and a sheep. Members of the agricultural engineering staff assisted the students and much credit goes to J. Stanley Winters for working out the details of design and construction for the wings and other parts. One prominent feature was the propeller which was attached to a crank operated by the pilot. Several thousand persons came to Davis on Picnic Day to be entertained by the student body and to see the college at its best. Those who were tall enough or in the right location caught the glimpse of the future portrayed in agricultural engineers float, and they wagged their heads approvingly.—W. L. Ruden

A Mechanical Refrigeration Study[1]

By M. P. Brunig[2]

IN A MECHANICAL refrigerator the heat is generally carried from the refrigerator by means of a gas which is condensed by a pump and its surplus heat carried away by ventilated tubes, the dissipation usually being hastened by means of a fan system in small units and by running water in large plants.

The value of proper ventilation to permit the dissipation of heat is shown by the accompanying graph of three periods of operation of a common type of refrigerator. The upper line of the graph shows the room temperature as given by a recording thermometer placed on a table beside the refrigerator. The next line shows the temperature of the refrigerator as recorded by a thermometer placed in the bottom of the refrigerator compartment. The lower shaded part of the chart shows the periods of operation of the motor and the quantity of electricity used.

Each period of operation began with ice trays filled with fresh water near 70 degrees Fahrenheit and approximately 16 pounds of water equivalent of the same temperature placed on the shelves. This meant that the useful work accomplished in each case was, for practical purposes, identical. That is, two trays of water were converted into ice and about 16 pounds of water equivalent were reduced from 68 to 38, 67 to 41, and 71 to 41 degrees, respectively. This is approximately 30 degrees fall in temperature in each case.

The electrical requirements per hour as shown by the graph were caused by controlled external conditions, conditions which could easily exist around any refrigerator if no thought were given to the matter.

The refrigerator was of the portable type. The condenser unit was in the base which was open at the rear but shielded by a screen in the front. The screen was removable.

In the first period the refrigerator was out from the wall, and the screen removed from the front. The graph shows a fairly uniform room temperature. The room was closed tight at night.

In the second period the refrigerator was left as for the first period but a 12-inch fan was in operation about 10 feet from the refrigerator during the full period of 24 hours. (In checking up afterwards we found that the air currents from this fan opposed the currents from the fan of the condenser unit, hence the rise from 0.106 to 0.109 kilowatt-hour per hour. This would indicate that the wrong kind of a draft in a room may even increase the electrical consumption.)

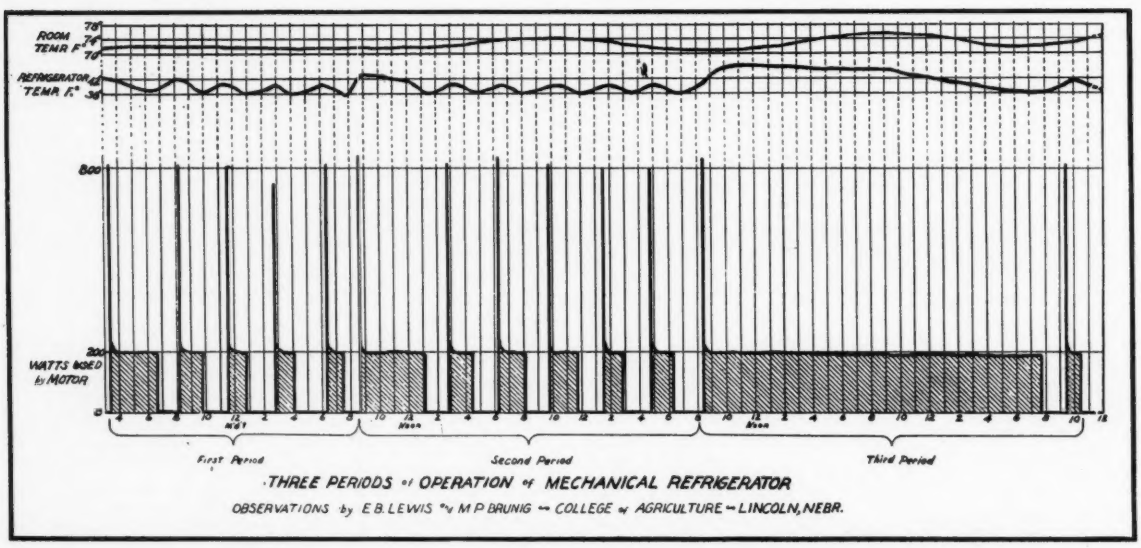
In the third period the outside fan was eliminated, a piece of wallboard was placed against the back of the refrigerator—closer than if the refrigerator had been pushed against the wall—and the screen was put in place at the front of the refrigerator. This so reduced the means of heat dissipation that the electrical consumption was raised from 0.106 to 0.180 kilowatt-hour per hour, an increase of nearly 70 per cent.

The results of this experiment would indicate that ventilation of the condenser unit plays an important part in the operation of an artificial refrigerator. The variation in this case from 0.106 to 0.180 kilowatt-hour per hour means a variation from 2.54 to 4.32 kilowatt-hours per day. In a month this would total 76.32 kilowatt-hours per month in one case and 129.6 kilowatt-hours per month in the other case. At 5 cents per kilowatt-hour this would mean the difference between a bill of $3.82 and $6.48.

It should not be understood, however, that these figures represent minimum and maximum costs of operation of a refrigerator of this type. The comparisons given here are only for three conditions of operation with respect to ventilation of the condenser unit.

[1]Report of observations on a "Kelvinator" mechanical refrigerator in the agricultural engineering laboratory of the University of Nebraska. The author wishes to acknowledge the cooperation of E. B. Lewis in conducting this study.

[2]Instructor in agricultural engineering, University of Nebraska. Assoc. Mem. A.S.A.E.


ROOM TEMP F°
REFRIGERATOR TEMP F°
WATTS USED by MOTOR
First Period
Second Period
Third Period
THREE PERIODS of OPERATION of MECHANICAL REFRIGERATOR
OBSERVATIONS by E.B. LEWIS & M.P. BRUNIG — COLLEGE of AGRICULTURE — LINCOLN, NEBR.

This graph shows the results of the observations of three periods of operation of a "Kelvinator" mechanical refrigerator made in the agricultural engineering laboratory of the University of Nebraska by M. P. Brunig and E. B. Lewis

Agricultural Engineering Digest

A review of current literature on agricultural engineering by R. W Trullinger, specialist in agricultural engineering, Office of Experiment Stations, U. S. Department of Agriculture. Requests for copies of publications abstracted should be addressed direct to the publisher.

Low Temperature Coal-Tar Creosote in Wood Preservation [trans. title], V. Hruban (Sborn. Vyzkumn. Ust. Zemedel. Repub. Ceskoslov. (Prague) Rec. Trav. Insts. Recherches Agron. Repub. Tchecoslov.) No. 30 (1927), pp. 73+[1], figs. 21; Eng. abs., pp 70-73).—Studies are reported which showed that on an artificial medium the toxicity of low temperature coal-tar creosote is about half that of high temperature creosote and double that of mercuric chloride. On the other hand, when impregnated into wood the toxicity against the attack of Coniophora cerebella of both kinds of creosote was found to be smaller than that of mercuric chloride.

The results indicated that low temperature creosote on the whole fulfills the requirements of permanency comparatively well, it being slightly superior as to constancy of weight and slightly inferior as to constancy of toxicity as compared with the high temperature creosote. No injuring of wood was ascertained in any case. Parts of the low temperature creosote were found to be leached out to a greater extent than those of the high temperature creosote, but the leaching out does not attain an extraordinary degree. The low temperature creosote was found to be superior as to waterproofing quality since it decreases the rate of absorption of water by wood. However, neither of the two kinds of creosote protected wood against the absorption of water to such an extent as to prevent the growth of fungi in wood in contact with a constantly wet medium. No difference was found in the penetration of the two types of creosote into wood.

The results showed that the low temperature creosote fulfills the requirements of a preservative. It can therefore, be expected that wood treated with low temperature creosote will attain an average life between that of wood similarly treated with high temperature creosote and the average life of kyanized wood.

[Agricultural Engineering Investigations at the Michigan Station], H. H. Musselman (Michigan Station (East Lansing) Report 1927, pp. 357, 358.—A brief statement of progress in investigations in power and machinery, buildings and conveniences, and drainage and land development at the station is given. Tests of mole drainage over three years showed that the annual cost of this system will be but a fraction of the annual cost of tile drainage.

Fires in Cotton Gins and How to Prevent Them, H. E. Roethe (U. S. Department of Agriculture Circular 76 (1929), pp. 8, figs. 4).—This circular is a revision of and supersedes Circulars 28 and 271. It describes the causes of cotton gin fires and the conditions under which they occur and gives information on how to prevent them.

Investigations of American Combines in the Summer of 1928 (Separate from Reichskurator. Tech. Landw. Ber., 1 (1928), pp. 10, figs. 2).—Field tests of seven American combines for harvesting and threshing barley, wheat, rye, oats and mixtures of these grains in different parts of Germany representing variable climatic conditions are reported.

The results deal especially with the handling of the grain and straw and the technical adjustments and modifications of the machines to adapt them to German conditions.

The results as a whole are taken as a warning against overoptimism for the use of the combine in Germany. While allowance is made for the limited duration of the tests and the difficulties experienced in adaptation, it was found that the total cost of the process was almost as high as harvesting with the binder and threshing separately. The indications are, however, that further development of the process and equipment along specific lines will reduce the total cost.

High Compression and Antiknock Fuels, L. C. Lichty (S. A. E. [Society of Automotive Engineers] Journal, (New York) 24 (1929), No. 3, pp. 290-294, figs. 9).—Studies conducted at Yale University are reported, which constituted an analysis of the economic value of the use of high compressions from the viewpoints of fuel cost, carbon-removal cost, and engine performance.

The results indicate that the carbon-removal saving resulting from the use of a fixed doped fuel, is highest for the lowest compression ratio, and vice versa. The fuel saving has a definite relationship with compression ratio and is directly proportional to the cost of fuel for any compression ratio. For a given dope, the carbon-removal saving is principally a fixed item, which varies only with the cost of removing the carbon. With low fuel costs no saving seems to result from the use of doped fuels with the present compression ratios. With higher fuel costs the net saving becomes considerable. For 30-cent gasoline a net saving of more than 150 per cent of the doped cost is shown for compression ratios varying between 6.8 and 7.8 to 1. The economy of the use of doped fuel at a compression ratio of 5 to 1 depends entirely upon carbon-removal saving, a low cost of carbon removal and long mileage before removing carbon, making the use of doped fuel uneconomical, and vice versa. Under actual operating conditions at the lower speeds, the fuel economy resulting from higher compression with the existing gear ratio will be less than expected from a full-load analysis. The expected fuel economy, better performance at the higher speeds, higher maximum speed, and lower engine speeds can be obtained by decreasing the gear reduction when decreasing the compression.

The Effect of Different Speeds on the Power Requirements of a Mower [trans. title], W. Vollenweider (Technik Landw. (Berlin), 10 (1929), No. 1, pp. 1-4, figs. 5).—Field and laboratory experiments, conducted under Swiss conditions, on the effect of speed of operation on the useful accomplishment and corresponding power requirement of a mower, are reported.

The results as a whole indicate that the efficiency of a mower decreases with increasing speed. It appears that a relatively large proportion of the power required in the operation of a mower is expended in overcoming the inertia and mechanical friction of the machine itself. This was determined on the testing stand and could be expressed in terms of heat loss. The frictional losses were found to increase almost with the cube of the speed.

The efficiency was increased by proper shaping of sickle teeth, exact alignment of the crank wheel, the use of antifriction bearings, balance of the crankshaft and pitman, and uniformity in the sickle reaction to avoid vibration.

At a forward speed of about 8 feet per second the power required was normally about 7 hp., but in tough or tangled grass this could easily be increased to 9 or 10 hp. and the efficiency decreased correspondingly. A much higher efficiency was obtained when two mowers were hitched to one tractor and operation proceeded at a lower speed.

It was found that to express power requirements in terms of unit width of swath cut does not give an adequate representation of actual conditions.

Self-Cleaning Thresher for Single Plants, J. B. Harrington (Society of Agronomy, (Ottawa, Can.) 8 (1928), No. 9, pp. 567-569, figs. 3).—This is a contribution from the University of Saskatchewan, which was presented at the annual meeting of the Western Canadian Society of Agronomy, Winnipeg, Man., December, 1927. It briefly describes a machine for threshing and cleaning the seed of single plants rapidly.

Investigations on the Tractive Resistance of Farm Wagons [trans. title], M. Voelter (Technik. Landwirtschaft, (Berlin) 10 (1929), Nos. 2, pp. 34-38, figs. 15; 3, pp. 61-64, figs. 12.—The results of a large number of experiments on the tractive resistance of two and four-wheel farm wagons under different conditions are reported from the mechanical department of the Agricultural Academy of Berlin.

The results with a two-wheel wagon on five different soil types indicated that tractive resistance depends mainly on the wheel dimensions on both light and heavy soils. The draft decreases as the wheel diameter increases. Four-wheel wagons with the same loads and wheel dimensions showed a lower draft than did two-wheel wagons. The draft also varied with the angle of the hitch, the optimum angle being between 12 and 20 degrees. A uniform distribution of the load over front and rear wheels of the four-wheel wagon was also in favor of lower draft.

Tests of the influence on draft of manner of mounting the wheels showed that the use of roller bearing axles caused a considerable saving of draft over friction bearing axles.

The use of spring hitches did not in general decrease the total draft load by smoothing out the draft curve. Increasing the weight of the wheels was without noteworthy influence on the draft of two-wheel wagons. The draft was lower where sand and dust-proof hubs were used.

Ignition Requirements for High-Compression Engines, J. T. Fitzsimmons (S. A. E. [Society of Automotive Engineers] Journal, (New York), 24 (1929), No. 3, pp. 306-314, figs. 15).—The essential parts of the battery ignition system are listed, and the required mechanical and electrical properties of a system that

will operate satisfactorily on high-speed, high-compression engines are described. The belief is expressed that a device that will automatically advance the spark above full-throttle position when operating at low load with partly closed throttle will make possible a better carburetor setting on part throttle and result in better fuel economy at low speeds.

Can Washing Machines [trans. title], Schulz (Schr. Reichskurator. Technologist Landwirtschaft, (Berlin) No. 3, (1929) pp. 91, figs. 48).—A study is reported of the construction and adaptation of can washing machines for German dairies.

The first part of this report reviews the progress of milk can washing and describes present methods and apparatus and their adaptation to the local German dairy industry. The second part reports tests of methods and equipment for can washing in dairies, which dealt with the mechanical, bacteriological and chemical features of can washing and cleaning.

The results as a whole indicate the superiority of mechanical cleaning over hand cleaning for the inside of milk cans and the superiority of hand cleaning for the outside of the cans. However, it appears that the internal cleaning by mechanical means is still far from perfect, and considerable research is necessary to correct the defects of available methods and equipment.

Metallic Colloids and Knock Suppression, H. L. Olin and W. J. Jebens (Industrial and Engineering Chemistry (Washington, D. C.) 21 (1929), No. 1, p. 43, fig. 1).—A brief report of studies conducted at the University of Iowa is presented, in which tests were made of the antiknock properties of nickel colloids prepared at different temperatures in a laboratory engine using ordinary gasoline. The results show a successive decrease in useful compression ratio as the temperature of decomposition is raised. At 69 degrees (Centigrade) the product is nearly as effective as the fuel with undecomposed nickel carbonyl, but at 85 degrees the improvement becomes negligible. Data are also presented on the antiknock properties of lead colloids prepared at different temperatures.

Study Made of Garden Tractor in Michigan, E. C. Sauve (Michigan Station (East Lansing) Quarterly Bulletin, 11 (1929), No. 3, pp. 126-129).—The results of a study of garden tractors are briefly reported, indicating that the garden tractor is approaching the degree of satisfactory performance found in the larger farm tractor.

Harvesting Corn with Field Ensilage Cutter, E. A. Silver (Ohio Station (Wooster) Bulletin 431 (1929), pp. 141-143, fig. 1).—Data on the use of the field silage cutter for corn harvesting are briefly reported. These show that the operating costs were slightly below those where the binder silage cutter is used. The distance of hauling seriously affects the cost of operation. The wagon hoist is a great timesaver and eliminates much hard labor in unloading the wagon. The average time required to raise the wagon and unload 4,000 pounds of silage was 5 minutes. The tractor was used to pull the wagons alongside because the harvester moves forward too rapidly for horses, It required one man four hours to change and sharpen the knives on the harvester. A much more uniform mixture of silage was secured.

Test on Lubricating Oils, M. V. Dover (Missouri University Engineering Experimental Station (Columbia) Bul. 27 (1928), pp. 52, figs. 18).—Tests to throw light on the effect of a prolonged treatment with ozone on the lubricating value and other properties of eight different samples of mineral oils and of samples of olive oil are reported.

The results showed that all of the lubricants are affected by proloned treatment with ozone, and that there is no definite relation between any of the chemical and physical properties and the so-called oiliness of the lubricants. In general the readings of the Deeley machine are more regular after the lubricant has been treated with ozone than before treatment. There are indications that the lubricants are inclined to corrode metals in contact with them for a rather long period of time after prolonged treatment with ozone.

Investigation of Warm-Air Furnaces and Heating Systems, III, A. C. Willard, A. P. Kratz, and V. S. Day (Illinois University, Engineering Experiment Station (Urbana), Bulletin 188 (1929), pp. 82, figs. 53).—This is the fifth of a series of reports of the results of warm-air furnace research. A large amount of data is presented and discussed relating to the crab-radiator type of furnace, open-dome type of furnace and different furnace arrangements.

Experiments on the effect of length of leader on the heat delivered at the register showed that the resistance of the leader pipe is of less importance in the determination of heating effect obtainable than is the resistance of the stack where the stack area is less than the leader area. The pitch of the leader pipe is not an important factor in the heating effect of a piping system having fixed heights between furnace and registers. It is more important to limit the length of leader pipe to first floors than to second floors. In designing systems on the basis of register air temperature, a uniform temperature should not be assumed to exist at the registers if much variation in the length of leader pipe exists. Instead, the individual pipe sizes should be based on their respective and correct register air temperatures.

Experiments on warm-air leader-pipe coverings and surfaces showed slightly superior performance by air-cell insulation over the entire test range. However, the results were such as to place a doubtful value on the insulation of bright tin warm-air leader pipes, except where these pipes are exposed to the chilling effects of leaky basement windows, are extremely long, or pass through cold walls.

Experiments on the effect of elbows in leader pipes showed that an elbow in a pipe to a second-story register causes a reduction in heating effect of 4.9 per cent, as compared with the same pipe without an elbow. The effect of one elbow in a first-story pipe causes a reduction in heating effect of 3.3 per cent.

A comparison of floor and wall types of registers showed that in the case of second-story floor register combinations in which an elbow at the top of the stack is necessary, the heating effect for a floor register combination is decidedly lower than for a wall register combination on the same stack. The choice between floor and wall types of register combinations should favor that system which offers the least resistance due to elbows or angles. In the case of register combinations on first-story pipes, the results indicated that for a given register air temperature the baseboard register combination has slightly less heating capacity than the floor register combination, although the particular arrangements of fittings used may have a marked effect on performance.

The Improved Venturi Flume, R. L. Parshall (Colorado Station (Fort Collins) Bulletin 336 (1928), pp. 84, figs. 30).—The results of studies of an improved Venturi flume are reported.

This flume has shown in field operation that it is practical under conditions which make a standard weir or rating flume impractical, either because of silting trouble or insufficient grade. The accuracy of measurement with this device is entirely within practical limits. It operates successfully with a relatively small loss of head, and for free flow this loss in a standard weir is approximately four times that in the flume The flume will withstand a high degree of submergence without affecting the rate of free-flow discharge. The structure may be built of wood, concrete or sheet metal.

It has been found that where the degree of submergence exceeds about 95 per cent, the indicated discharge through the flume is not wholly dependable, so that if conditions permit the discharge should be free flow or with the least possible degree of submergence. For free flow the exit velocity is relatively high, and bottom as well as bank protection must be provided to prevent erosion. Where the materials are of such a nature as to withstand a high velocity, no protection is needed.

Book Review

"Wiring the Farm for Light, Heat and Power" is an 80-page, profusely illustrated booklet which embodies the best knowledge that has become available on the subject since the rural electrification movement began. It is written for the farmer, not to make a wiring expert out of him, but to teach him the fundamentals and enable him to tell the difference between good and bad wiring materials and workmanship. It is published by the Committee on the Relation of Electricity to Agriculture as Vol. 5, No. 1 of the C.R.E.A. Bulletin, and is available in quantities to utilities which wish to distribute it among their customers. For orders of one to ten the price is 50 cents per copy; 11 to 99, 35 cents per copy; and 100 and over, 25 cents per copy. Orders should be sent to the Committee at 1120 Garland Building, Chicago, Illinois; money orders and checks made payable to G. C. Neff, Treasurer, C.R.E.A.

"What About the Year 2000," is subtitled "An Economic Summary of Answers to the Vital Questions: Will our Land Area in the United States Meet the Demands of our Future Population? How are We to Determine the Best Use of Our Land Resources?" It represents a preliminary analysis of available data on land uses by the Joint Committee on Bases of Sound Land Policies of the Federated Societies on Planning and Parks. Considerable space is devoted to agricultural uses of land and account is taken of the present and probable future influence of tractors and other engineering and scientific developments on the efficiency of land use. A bibliography is included. The book is published by the J. Horace McFarland Company, Harrisburg, Pa. Price, $1.00.

The **"American Standards Year Book,"** 1929 edition, is an 88-page booklet covering important developments of the past year in industrial standardization. New standards completed and new projects initiated are described in some detail; and national standards completed, national projects now under way, members of the Association, cooperative organizations and individuals active in the work are listed. A foreword by Robert P. Lamont, U. S. Secretary of Commerce, is given. Copies of the booklet are available to organizations interested in the work.

Who's Who in Agricultural Engineering

J. E. Waggoner

D. S. Weaver

R. T. Wagner

C. E. Seitz

J. E. Waggoner

Jacob Enon Waggoner (Mem. A.S.A.E.)—vice-chairman of the A.S.A.E. Rural Electric Division—is manager of the public relations division of the sales department, Delco-Light Company. He received his bachelor's degree in mechanical engineering at Iowa State College in 1908 and his bachelor's degree in agricultural engineering in 1910, at the same institution. It has since, in 1920, conferred upon him the professional agricultural engineering degree. Immediately following his graduation in 1910 he went to the Mississippi A. & M. College to organize an agricultural engineering department there. Later in the same year, however, he was employed by the International Harvester Company to organize and manage its service bureau, which has since developed into the agricultural extension department of the company. In 1915 he was made advertising editor for the power farming equipment line of the company and only left this position in 1926 to enter the rural electrification field as director of the Texas Committee on the Relation of Electricity to Agriculture. While in this position he prepared and edited the bulletin, "Electricity on Texas Farms." In 1928 he accepted his present position.

D. S. Weaver

David Stathem Weaver (Assoc. Mem. A.S.A.E.) is associate professor of agricultural engineering in charge of the division of agricultural engineering at North Carolina State College of Agriculture and Engineering. He is a graduate of the mechanical course of a technical high school in Cincinnati, Ohio. The war interrupted his college education, but following a year of service in the United States Army he reentered college, specializing in agricultural engineering at Ohio State University, and graduated in 1920. Following graduation he assisted in the department with rehabilitation students in agricultural engineering. From 1921 to 1923 he was instructor and then assistant professor of agricultural engineering at Mississippi A. & M. College. In September, 1923, he accepted his present position and received a master's degree in agricultural engineering in 1925 from North Carolina State College of Agriculture and Engineering. The use of machinery and consequent reduction of hand labor in cotton production is his speciality. He has been particularly active in the organization and development of the Southern Section of the Society, of which he is now chairman.

R. T. Wagner

Ray Taber Wagner (Mem. A.S.A.E.) is commercial engineer in the central station department and in charge of the rural electrification work of the General Electric Company. He received his bachelor's degree in electrical engineering at the University of Wisconsin in 1905 and has been associated with the General Electric Company continuously since then. He is one of the representatives of the National Electric Manufacturers Association on the Committee on the Relation of Electricity to Agriculture. The rural electrification course of the General Electric Company is one of his ideas. It gives a limited number of agricultural engineering graduates special training for rural electrification work with public utilities. He has also kept in close touch with the various state rural electrification projects and helped them with engineering equipment and technical assistance. In the Society, and particularly the Rural Electric Division and the North Atlantic Section, he has been active since becoming a member, in 1925, in the early days of rural electrification. He helped to organize and served a term as chairman of the North Atlantic Section.

C. E. Seitz

Charles Edward Seitz (Mem. A.S.A.E.) is professor and head of the department of agricultural engineering at Virginia Polytechnic Institute. A native of Nevada, he obtained the first two years of his college training in the University of Nevada, then spent two years in railroad engineering in California and Oregon, and went east to Ontario Agricultural College the two succeeding years. From there he went to Virginia in 1914 to start extension work in agricultural engineering. After serving in the cavalry and the aviation corps during the war he returned to Virginia Polytechnic Institute at the request of its president to organize and become the head of a department of agricultural engineering. A few years later he planned and secured the approval of the college faculty for the four-year professional course in agricultural engineering now on the curriculum of the Institute. This was the first course of its kind to be offered east of the Mississippi river. In 1924 he took the initiative in organizing the rural electrification movement in Virginia. He has been active in the Society, is author of bulletins and articles on agricultural engineering subjects, and is at present agricultural engineering editor of the "Southern Planter."

AGRICULTURAL ENGINEERING

Established 1920

A journal devoted to the advancement of the theory and practice of engineering as applied to agriculture and of the allied arts and sciences. Published monthly by the American Society of Agricultural Engineers, under the direction of the Publications Committee.

PUBLICATIONS COMMITTEE

G. W. Iverson, Chairman

F. A. Wirt — R. W. Trullinger

P. S. Rose — C. O. Reed

The Society is not responsible for the statements and opinions contained in the papers and discussions published in this journal. They represent the views of the individuals to whom they are credited and are not binding on the Society as a whole.

Contributions of interest and value, especially on new developments in the field of agricultural engineering, are invited for publication in this journal. Its columns are open for discussions on all phases of agricultural engineering. Communications on subjects of timely interest to agricultural engineers, or comments on the contents of this journal or the activities of the Society, are also welcome.

Original articles, papers, discussions, and reports may be reprinted from this publication, provided proper credit is given.

RAYMOND OLNEY, Editor

R. A. Palmer, Assistant Editor

The Philosophy of Mike Thomas

BEFORE you can benefit a person a group of persons you must overcome the resistance of the beneficiary. Do not be discouraged because people do not accept your ideas immediately. You can work whether people like to or not—when you are dead you will receive the credit for it. These, in substance, were some of the words of wisdom which M. H. (Mike) Thomas, largest cotton broker and self-made man of the South, passed on to agricultural engineers at the Dallas meeting.

He could scarcely have found an audience to which this advice would be more appropriate. At practically every turn agricultural engineers have met the resistance of not only farmers but farm leaders and the public in general; a resistance which is a composite of the traditions, prejudices, ignorance, sentiment, conservatism and inertia naturally associated with the oldest and slowest moving of industries. McCormick with his first reaper was ridiculed. Iron plows were long believed to poison the ground. Today many farmers must be required by regulation to take measures to control the corn borer and similar pests. And with more efficient farming possible through knowledge and equipment now available, many farmers still follow their accustomed ways, right or wrong, gloat over their independence, and obstinately refuse to improve their methods. Others are taking half-way measures and making slow progress. The lag between the development and the general application of engineering improvements in agriculture—the period of overcoming the resistance of the beneficiaries—must be measured in decades and years.

Agricultural engineering is far enough along now, however, so that we can see farmers using the implements and methods they laughed at and called impossible a few years ago. It is also apparent that the resistance of farmers to change and improvement is weakening. More and more of them are becoming progressive, applying the best knowledge and equipment available and demanding more knowledge and equipment. They are also leading their slower neighbors in the direction of progress.

In view of these facts we can analyze, design, construct, develop, test, advocate and teach with less concern over the resistance of our beneficiaries, and with greater confidence in our technique and the ultimate value of our work, than ever before.

Recent Economic Changes

A BRIEF, interestingly written, economically sound, educational, and optimistic report of where we stand in the world of business is that of the Committee on Recent Economic Changes. Though it is scarcely mentioned, many a lesson for agriculture can be read between the lines.

It is economically sound because it is the interpretation placed by a group of the nation's leading economists, engineers, statisticians and business men on the results of a fact-finding survey. It is educational because it shows more clearly than ever before that prosperity is essentially a balanced condition of production and consumption on a scale large enough to satisfy a relatively large proportion of the material wants of the individuals or group to which it applies. It is optimistic because the authors believe that the present state of prosperity can, with diligence, be not only maintained but added to indefinitely.

Dangers mentioned which might upset the apple-cart are ignorance of economic principles, selfish greed, and inadequate economic leadership. To prevent such a disaster the suggestion was that a technique of economic balance be developed.

An apparent weakness of the report is that it emphasizes the insatiability of people's wants without analyzing it. That people's wants are insatiable seems undoubtedly true. But the demand is in the direction of infinite variety rather than of unlimited quantity. The tendency of production, on the other hand, is to expand more in the direction of quantity rather than variety.

In other words, we have studied production and learned how to produce efficiently and in almost unlimited quantity. We have scarcely begun to study consumption and the possibility of discovering latent wants or developing new wants to be satisfied with present commodities or with new ones to be developed, thus to keep consumption in balance with our growing capacity for production, and to thereby increase prosperity.

The committee satisfies itself on this point with a brief statement that the saturation point is a long way in the future, particularly in the electrical appliance industry. How about agriculture though? There it presents a present day problem which cannot be sidestepped in any sincere attempt to develop a technique of balance between production and consumption.

Help Wanted

WHILE unemployment statistics seem appalling, trade unions close their doors to new members, and men stand in long lines before employment offices, every progressive, growing business, art, science and profession is keeping a sharp lookout for men. At every meeting of agricultural engineers, for example, it is apparent that they would move the world if they could only get some more men.

The men who stand in line will work for a living wage. Those who are on the lookout for men will pay many times a living wage—for the right man.

With the growing complexity of civilization the developing of men consistent with their inherent capacities and fitting them into positions is a growing rather than diminishing problem.

The junior high schools, high schools and colleges could do much to bring about a more equitable distribution of man power by placing more emphasis on ideals of service and backing this up with facts on the labor market and the employment problems men may expect to meet in the various occupations and callings. Having such knowledge at the time of decision, fewer young men might choose the path of least resistance, job lines might become shorter, and business, the arts, sciences and professions have less difficulty in finding capable men.

A. S. A. E. and Related Activities

Student Branch Presents Key

THE Nebraska student branch of the American Society of Agricultural Engineers believes it is the first student branch to establish an award, in the form of a key, to be presented each year to the outstanding senior student in agricultural engineering.

This award is to be made at the annual engineers' banquet held during Engineers' Week near the close of the school year. The student thus honored is chosen by secret ballot by the members of the branch on a basis of sociability and practicality. This vote carries a weight of 70 per cent. The agricultural engineering faculty also has a vote which is based on scholarship and carries a weight of 30 per cent. The result of the election is known only to the faculty advisor of the branch who announces the award at the engineers' banquet.

The first student to receive this award is Donald Walker of Shelton, Nebraska. He was president of the Nebraska student branch of the American Society of Agricultural Engineers the past year and has been active in the affairs of the branch during his entire four years in school.

Mr. Walker plans to engage in large-scale farming at Shelton. He will be a valuable asset to his community. He is to be congratulated upon the honor received, and the student branch feels fortunate in having a man of his caliber to whom to present its first award.

American Engineering Council

AT ITS last meeting the administrative board of American Engineering Council instructed its executive secretary, L. W. Wallace, to again present a plea for increased appropriations for mapping facilities. Hon. Robert P. Lamont, Secretary of Commerce, and Hon. Ray L. Wilbur, Secretary of the Interior, have both been approached upon this subject. The Secretary of Commerce has under his jurisdiction the Coast and Geodetic Survey while the Interior Department supervises the work of the Geological Survey.

In order to secure efficient and economic operation of all major engineering projects, including city surveys and planning, highway development and extension, irrigation projects, hydroelectric developments, improvement of rivers for navigation, flood control of rivers, and general topographic surveying and mapping, a knowledge of elevations and geographic positions is required. The great activity in all of these directions has given rise to a marked demand for expediting the leveling and triangulation work being conducted by the Coast and Geodetic Survey. Completion of the fundamental leveling and triangulation needs of the country has been estimated to cost not in excess of five million dollars, according to the Board of Surveys and Maps of the federal government. This work should be completed within the next ten years.

Congress has recognized the need and demand for making of topographic surveys and maps by the passage of the Temple Act some years ago. This act authorized a program which would make possible the completion of the topographic survey of the United States within 25 years instead of extending it over a period of from 80 to 100 years, which will be the case under the present rate of work. The appropriating authorities have not recognized the provisions of the Temple Act, and there has been no material increase in the appropriations for topographic mapping since the passage of the Temple Act.

As required by the Boulder Canyon Project Act, approved December 21, 1928, President Hoover has issued a public proclamation that all prescribed conditions have been fulfilled, and that the act is effective as of June 25, 1929. At the time of the signing of this proclamation, President Hoover issued the following statement:

"I signed this morning the Colorado River proclamation, making effective, the compact between six of the seven states in the Colorado River Basin. I have a particular interest in its consummation not only because of its great intrinsic importance but because I was the chairman of the Colorado River Commission that formulated the compact.

"The compact itself relates entirely to the distribution of water rights between the seven states in the Basin. It has nothing per se to do with the Boulder Canyon development except that it removes the barriers to such development. . . . . ."

Secretary of the Interior Wilbur in an address at Las Vegas, Nevada, on June 22, enunciated a new government policy with reference to the Colorado River project. Secretary Wilbur said in part:

"Although the situation here is peculiarly difficult, I want to lay down a new policy for the government in dealing with these great power and reclamation projects. I would like to see the government come in and build reclamation projects, protect its investment through contracts that will pay the money back into the treasury and then withdraw from the field.

"Then the government would not get involved in situations purely local, situations calling for intricate settling of tax problems and bond issues or community and state's rights.

"When the government builds these great reclamation projects it is giving to certain communities what God already has given to others. When it has done that, the time has come for the government to withdraw from the picture."

The Secretary of the Interior has chosen Messrs. L. C. Hill, A.S.C.E.; A. J. Wiley, A.S.C.E., and W. F. Durand, A.S.M.E., to act as special consultants in the field service of the U. S. Bureau of Reclamation in connection with the development of the Boulder Canyon Dam project. All members of this board are exceedingly well known to the engineering profession.

These constitute the chief developments in the Colorado River project during the past month. It will be many months yet before contracts for construction of the dam are let.

Following a request from the American Society of Mechanical Engineers, American Engineering Council appointed a committee to confer with the Bureau of Census relative to the inclusion of the information on the number of man-hours employed in industry in the United States.

American Engineering Council selected the following committee: L. P. Alford, chairman; Glenn A. Bowers;

Ernest F. DuBrul; Kenneth C. Hogate; Laurence H. Sloan; Charles P. Tolman; and J. E. Hannum, secretary.

This committee had several conferences with representatives of the Census Bureau and has submitted its report of recommendations through the American Engineering Council to this organization. William M. Steuart, director, Bureau of the Census, has directed that a tentative study of this method of collecting information relative to certain key industries be tried in the next Census.

It has been the function of the U. S. Geological Survey since 1888 to systematically collect and make available data in regard to the water resources of the nation. This is an exceedingly useful service. The only criticism which has been expressed of this service has been that a sufficient amount of information has not been collected and made available. This has been due to insufficient appropriations by the federal government. The amount of work which has been completed to date would not have been realized had not state and local governmental agencies, individuals and corporations supplied the U. S. Geological Survey with funds in addition to those appropriated by the federal government. There is a widespread demand for materially increasing this work, and American Engineering Council has been called upon to give expression to this demand.

American Standards Association

EVIDENCE of the wide use of A.S.A. specifications for drain tile (A 6-1925) is furnished by W. J. Schlick (Mem. A.S.A.E.) drainage engineer, Iowa State College, who is secretary of the Sectional Committee on Drain Tile under the sponsorship of the American Society for Testing Materials and the U. S. Department of Agriculture. In reply to a request from W. J. Serrill, president of the A.S.A., for information about the use of this standard, Mr. Schlick writes:

"The standard specifications for drain tile have been sponsored actively by the Clay Products Association and the American Concrete Pipe Association representing the manufacturers of clay and concrete drain tile. They have been sponsored by such national organizations as the American Society of Agricultural Engineers and by such federal bureaus as the Bureau of Standards, Bureau of Reclamation, and Bureau of Public Roads. I know that they are sponsored by all of the state engineering schools in the Middle West and presume by all of the state engineering schools in the other sections where tile drainage is important. I do not believe that any other organization, either state, regional, or national, is now using or promoting any other standards for drain tile.

"Throughout the Middle West at least, I believe that if the term 'standard specifications for drain tile' was used before groups of either drainage engineers or drain tile manufacturers, they would understand that the Sectional Committee standards were meant. The Iowa State Highway Commission which has charge of the construction and maintenance of the state system of primary trunk highways uses a great many drain tile each year, and has always purchased and inspected these drain tile under these standard specifications."

Owing to the fact that only thirty-two of a total of one hundred and fifty companies replying to a questionnaire designed to learn how extensively certain types of single and multiple keys are used indicates that limited use that the sponsor has recommended that national standardization of these types of keps, which include saddle, flat, feather, tangent or Lewis, Barth, Kennedy, and round or Norberg, be not undertaken at present.

A new subcommittee of the Sectional Committee on the Standardization of Bolt, Nut and Rivet Proportions (B 18) was recently organized to formulate standards for socket head cap and set screws.

Copies of the first three parts of the code on protection against lightning (C 5) are available at the office of the American Standards Association, 29 West 39th St., New York, N. Y., at 25 cents per copy.

The American Society of Mechanical Engineers has submitted to the A.S.A. a request for the standardization of Diesel fuel oils (K 19).

A draft of symbols for mechanics, structural engineering and testing materials (Z 10a), prepared by a subcommittee is now in the hands of the Sectional Committee on Scientific and Engineering Symbols and Abbreviations. Copies of the draft will be loaned to those interested by the A.S.A. Information Service.

The proposed American Tentative Standard Symbols for Hydraulics (Z 10b) has been adopted by the Sectional Committee on Scientific and Engineering Symbols and Abbreviations and by the five sponsor bodies. The report is now being balloted on by the A.S.A. Copies of the proposed standard are available for review by those interested, and may be obtained on loan from the A.S.A. Information Service.

Personals of A.S.A.E. Members

Roy Bainer, assistant agricultural engineer, Kansas Engineering Experiment Station, and **H. S. Hinrichs,** formerly assistant agricultural engineer, Kansas Engineering Experiment Station, and field engineer of the Kansas Rural Electrical Laboratory, are joint authors of Extension Bulletin No. 63, entitled "Wiring the Farmstead," just issued by the extension service of the Kansas State Agricultural College.

A. B. Crane has opened an office at 1912-16th Street, Everett, Wash., as a practicing agricultural engineer, resigning as extension specialist in agricultural engineering of the State College of Washington.

A. D. Edgar has been appointed extension agricultural engineer for Michigan State College, East Lansing, Michigan. He was formerly assistant professor of agricultural engineering at the University of Idaho.

F. C. Fenton, professor of agricultural engineering, Kansas State Agricultural College, is joint author with O. D. Hunt, assistant professor of electrical engineering, at the same institution, of Extension Bulletin No. 64, entitled "Farm Lighting," just issued by the extension service of that institution.

H. H. Gordon has just joined the agricultural engineering staff of the Virginia Polytechnic Institute, as assistant extension agricultural engineer in charge of farm building extension work. He was previously field agricultural engineer of the Portland Cement Association in Virginia.

A. E. Halterman is now associated with the Ohio Edison Company as rural service engineer, his new address is 318 S. Court Street, Marysville, Ohio. He was formerly rural electric service manager for the Suburban Electric Power Company at Waldorf, Maryland.

B. Parker Hess, formerly field engineer of the Ohio Committee on the Relation of Electricity to Agriculture, is now rated as a senior in electrical engineering of the Ohio State University and at the same time is connected with the engineering experiment station staff as junior research engineer.

N. A. Kessler is now associate land clearing specialist, division of agricultural engineering, Bureau of Public Roads, U. S. Department of Agriculture, with headquarters in the agricultural engineering building, University Farm, St. Paul, Minnesota. He was formerly specialist in agricultural engineering of the Northeastern Michigan Development Bureau.

Speeding the Harvest

ALL McCormick-Deering power farming machines utilize, to the utmost, the undoubted advantages of anti-friction bearings.

The tractor and combine illustrated owe much of their economical and dependable operation to the power-saving, wear-resisting movement of the bearings which support all important shafts.

Of outstanding merit is the mounting of the tractor crankshaft on large New Departure Ball Bearings—a design which is thus readily lubricated and requires no adjustment. Over half a million New Departures have been used in these crankshafts with conspicuous success.

Other parts in which New Departures contribute to smooth running reliability are the magneto, governor, fan, clutch and pulley shaft—and the cylinder in the combine.

The New Departure Mfg. Company, General Offices and Main Works, Bristol, Connecticut; Engineering and Sales Offices, Detroit, Chicago, San Francisco, London.

A. J. McAdams recently joined the agricultural extension section of the E. I. Du Pont de Nemours & Company as agricultural representative for the Southwestern states. He was formerly extension assistant professor of agricultural engineering, University of Missouri. His address is 2 Hamilton Way, Columbia, Missouri.

D. G. Miller, senior drainage engineer, U. S. Department of Agriculture, is joint author with Stephen A. Wise of Technical Bulletin No. 52, entitled "Experimental and Mathematical Analyses of Drain Tile Testing and New Test Bearing," published by the Minnesota Agricultural Experiment Station.

F. C. North has resigned as lecturer in agricultural engineering at Macdonald College to become associated with the Stinson-Reeb Company, of Montreal, distributors of builders' supplies, which is making a speciality of merchandising and developing peat products, several large deposits of which it owns in eastern Canada. It will be Mr. North's job to develop the agricultural end of this enterprise.

C. L. Osterberger has been appointed to take charge of the rural service department of the Louisiana Power & Light Company, Algiers, Louisiana, effective June 15. He was formerly a member of the agricultural engineering staff of the Louisiana State University and for the past year has been acting head of the department.

R. R. Parks, agricultural engineer, University of Missouri, is author of Bulletin No. 268, entitled "The Use of Electricity on Missouri Farms," recently issued by that institution.

E. R. Raney has been appointed agricultural engineer in charge of farm promotion work for the state of Texas by the Portland Cement Association, with headquarters at the Athletic Club Building, Dallas. Mr. Raney was formerly agricultural engineer for the J. C. Penney-Gwinn agricultural development project in Florida and more recently associated with the agricultural engineering department of the A. & M. College of Texas.

Otto Schnellbach, engineer, department for the supervision of agricultural engineering research, German Department of Agriculture, recently wrote an A.S.A.E. member in the U.S.A. that, during the annual exhibition of the German Agricultural Society at Munich, the agricultural engineers held a meeting (June 4) in the beautiful laboratories of **Dr. George Kuehne,** head of the agricultural engineering department of the Technical Academy of the State of Bavaria. This laboratory is the most modern one in Germany and is very completely equipped for teaching and research work.

Frank J. Zink has been appointed agricultural-electrical engineer in the Chicago office of the Westinghouse Electric & Manufacturing Company, 111 W. Washington St., Chicago. He was formerly field engineer of the Iowa rural electrification project.

New A.S.A.E. Members

Henry L. Boyer, commercial sales department, Goulds Pumps, Inc., Seneca Falls, N. Y.

John S. Glass, extension agricultural engineer, Kansas State Agricultural College, Manhattan, Kans.

Archie H. Glaves, junior engineer, U. S. Department of Agriculture, 615 Front St., Toledo, Ohio.

Howard F. McColly, instructor in agricultural engineering, North Dakota Agricultural College, Fargo, N. D.

Transfer of Grade

Merle W. Bloom, engineering and development, General Implement Co., Racine, Wis. (Junior to Associate Member.)

F. Addison Lyman, managing director, Farm Fence Institute, Chicago, Ill. (Junior to Associate Member.)

H. H. Sunderlin, supervisor of training, Caterpillar Tractor Co., Peoria, Ill. (Associate to Full Member.)

Applicants for Membership

The following is a list of applicants for membership in the American Society of Agricultural Engineers received since the publication of the July issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Hardin L. Atkins, Jr., associate editor, "The Progressive Farmer," Dallas, Tex.

Durga N. Banwet, lecturer, The Maclagan Engineering College, Moghalpura, Lahore, Panjab, India.

S. S. Conaway, sales promotion manager, Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa

John E. Dougherty, associate professor of poultry husbandry, University Farm, Davis, Calif.

Joseph E. Hooker, agricultural engineer, South Carolina Agricultural Extension Service, Columbia, S. C.

Hendrik de Leeuw, agricultural engineer, 14 West 90th St., New York, N. Y.

Franklin D. Lown, agricultural advisor, San Antonio Suburban Irrigated Farms, San Antonio, Tex.

Earl I. Myers, civil engineer, Clark E. Jacoby Engineering Co., Kansas City, Mo.

Leonard G. Schoenleber, junior engineer, U. S. Department of Agriculture, 615 Front St., Toledo, Ohio.

D. E. Wiant, instructor in agricultural engineering, South Dakota State College, Brookings, S. D.

Transfer of Grade

George R. Louthan, experimental engineer, General Implement Co., Racine, Wis. (Student to Junior Member.)

Ralph A. Palmer, assistant secretary, American Society of Agricultural Engineers, St. Joseph, Mich. (Junior to Associate Member.)

Raymond J. Tillotson, rural service engineer, Kansas Gas & Electric Co., Newton, Kans. (Student to Junior Member.)

Employment Bulletin

Men Available

SOILS EXPERT, with national reputation, for many years engaged in practical research work in soil manipulation and improvement and in the development of tillage equipment, desires connection with large farming enterprise or with banking, insurance, or mortgage company where his ability and experience in building up worn-out farm lands for profitable production is needed. MA-164.

Positions Open

AGRICULTURAL ENGINEER wanted to fill position as instructor or assistant professor in the department of agricultural engineering of one of the land grant colleges of the Northwest. A recent graduate in agricultural engineering qualified for rural electrification and power farming with farm and practical experience is desired. Opportunity offered for research work and for participation in experiment station and extension service projects. Teaching work required will be largely in service courses in agricultural engineering. Minimum salary $1800 to $2100 per year on twelve months basis with one month vacation. P.O. 155.

AGRICULTURAL ENGINEER with some knowledge of the design and construction of farm buildings wanted to fill position in engineering department of a farm building equipment manufacturer in the Middle West. Position must be filled by September 1 or 15. Salary to start with will be around $125. PO-157

AGRICULTURAL ENGINEERS, preferably young men, wanted by a manaufacturer of agricultural explosives for development work. Salary at start $100 to $125 per month plus traveling expenses. PO-158

AGRICULTURAL ENGINEER wanted to teach courses in farm machinery and farm mechanics in a Canadian agricultural College. Specialist in agricultural engineering with some teaching or extension experience preferred. PO-159